US Army Corps of Engineers Hurricanes Katrina and Rita Response and Recovery

by

Colonel Duane Gapinski, P.E.

Agenda

US Army Corps of Engineers

Task Force Hope

The Unwatering of New Orleans

The Hurricane Protection System Way Ahead

US Army Corps
of Engineers ®

U.S. Army Corps of Engineers

Dual Roles

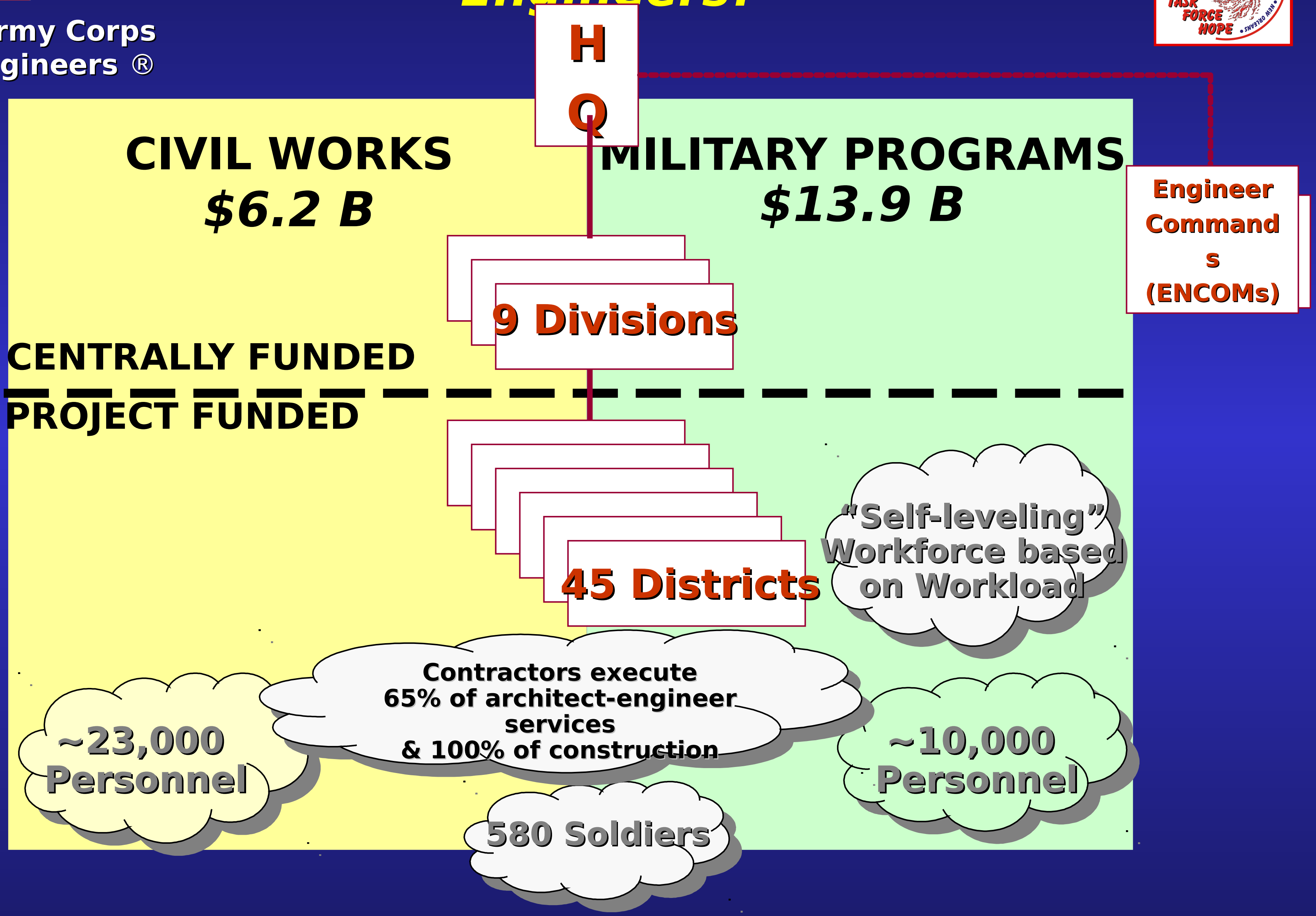
Chief of Engineers, Army Staff

★ ★ ★

Commander, U.S. Army Corps of Engineers

US Army Corps
of Engineers ®

What is the US Army Corps of Engineers?



HQ

CIVIL WORKS
$6.2 B

MILITARY PROGRAMS
$13.9 B

Engineer Commands (ENCOMs)

9 Divisions

CENTRALLY FUNDED

PROJECT FUNDED

45 Districts

"Self-leveling" Workforce based on Workload

Contractors execute 65% of architect-engineer services & 100% of construction

~23,000 Personnel

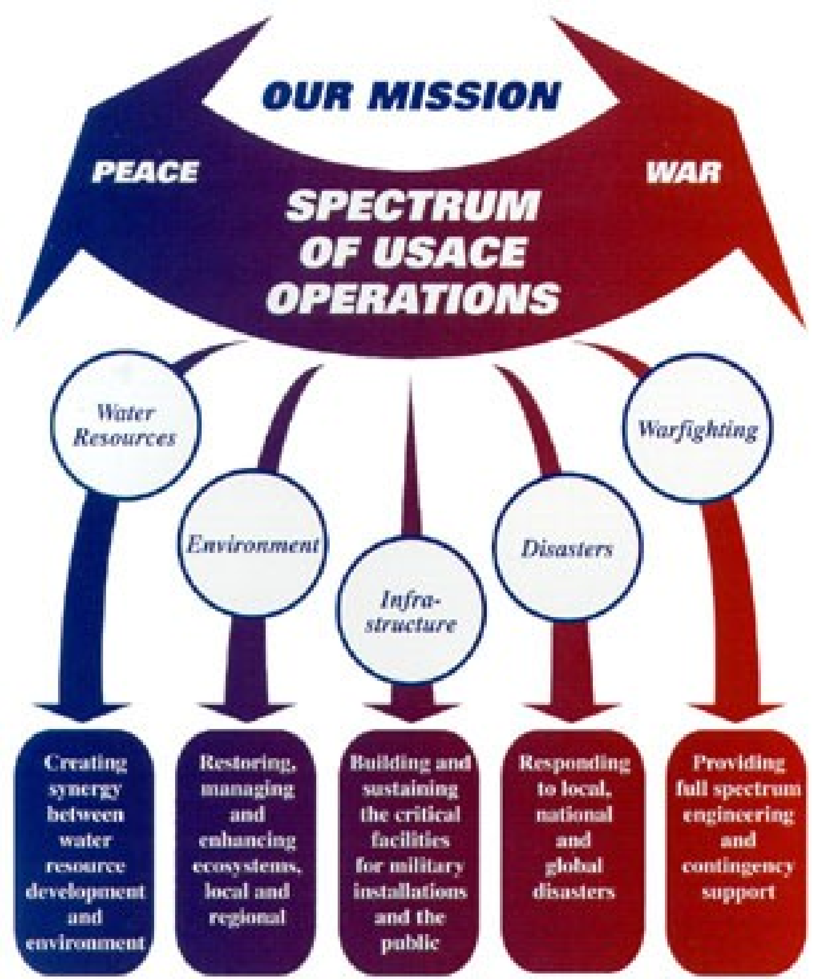
~10,000 Personnel

580 Soldiers

US Army Corps
of Engineers ®

U.S. Army Corps of Engineers

- The Corps’ mission:
  - Water Resources Development
  - Environment
  - Infrastructure
  - Disasters
  - Warfighting


OUR MISSION
PEACE
WAR
SPECTRUM OF USACE OPERATIONS
Water Resources
Environment
Infra-structure
Disasters
Warfighting

Creating synergy between water resource development and environment

Restoring, managing and enhancing ecosystems, local and regional

Building and sustaining the critical facilities for military installations and the public

Responding to local, national and global disasters

Providing full spectrum engineering and contingency support

Navigation

Flood Damage Reduction

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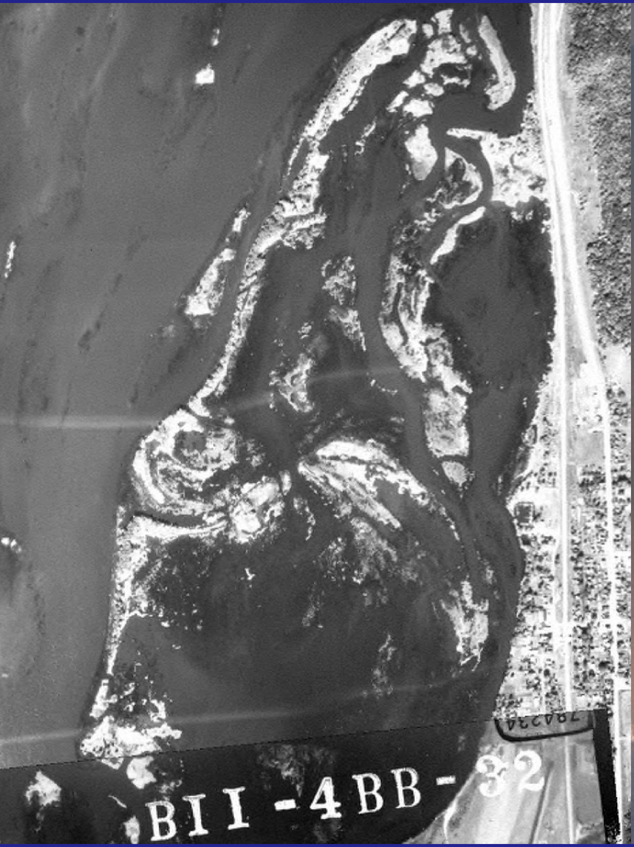
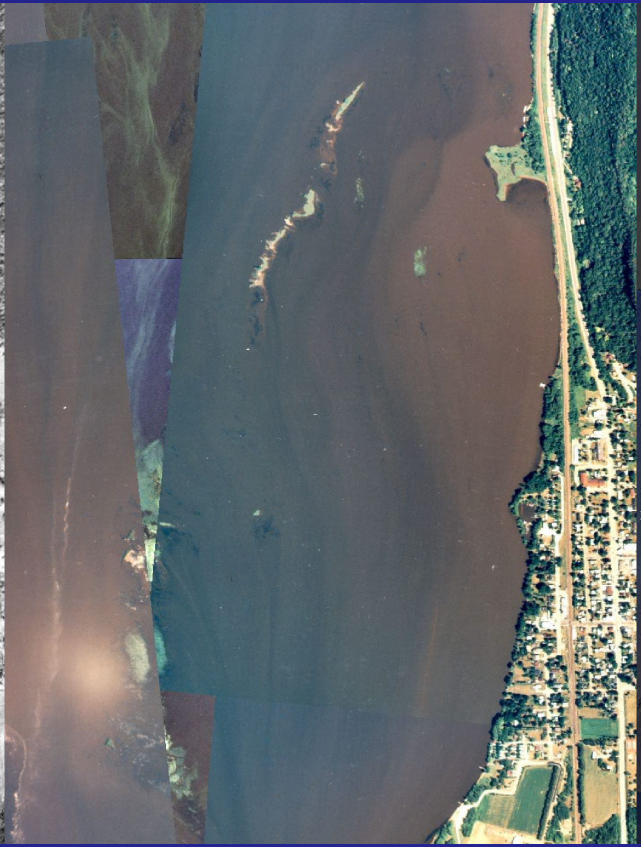
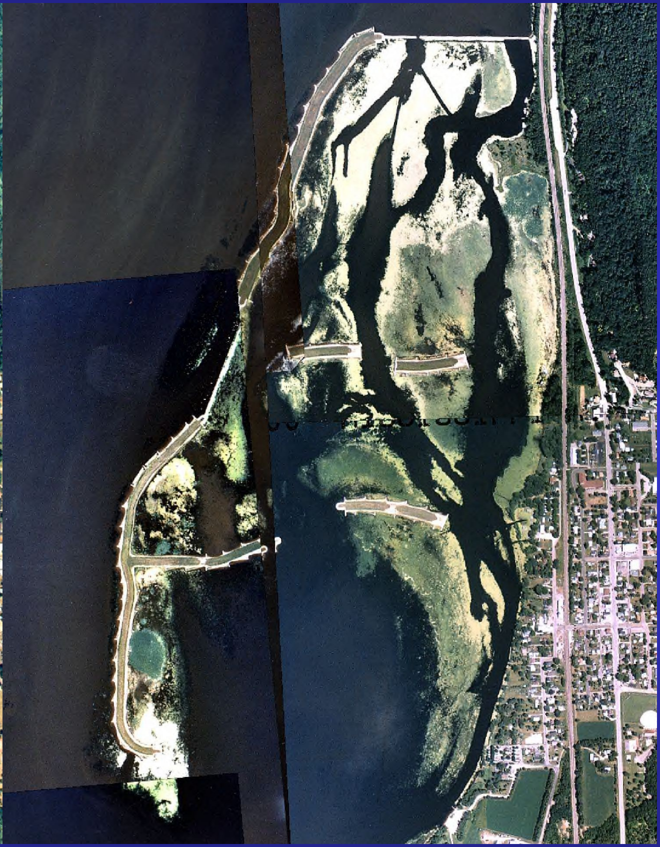
Ecosystem Restoration



October 1961



August 1994



August 2000

Emergency Response

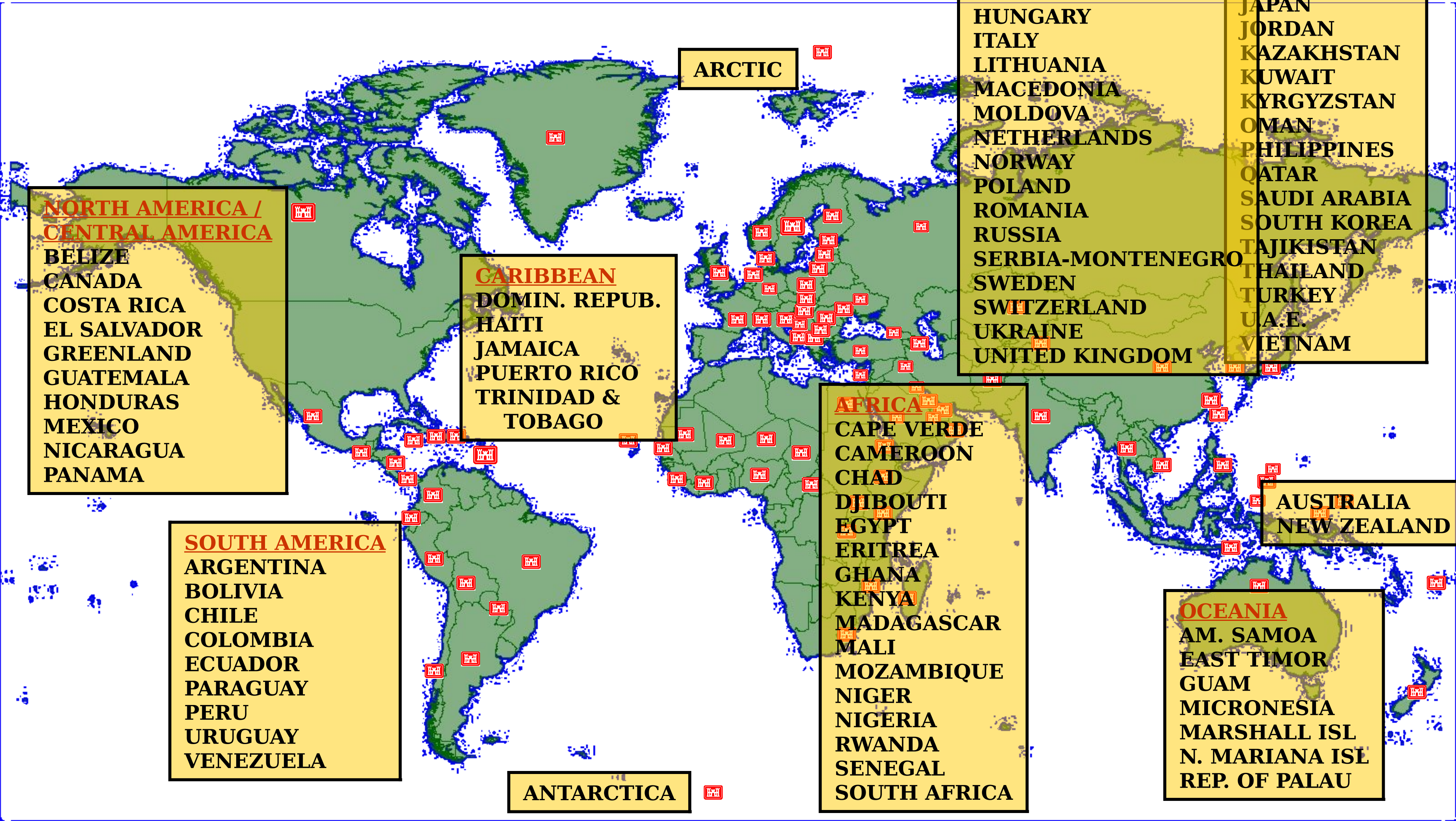
Emergency Operations

Support to the Military

US Army Corps
of Engineers ®

One Team: Relevant, Ready, Responsive, Reliable

USACE Around the World



ARCTIC

NORTH AMERICA / CENTRAL AMERICA
- BELIZE
- CANADA
- COSTA RICA
- EL SALVADOR
- GREENLAND
- GUATEMALA
- HONDURAS
- MEXICO
- NICARAGUA
- PANAMA

CARIBBEAN
- DOMIN. REPUB.
- HAITI
- JAMAICA
- PUERTO RICO
- TRINIDAD & TOBAGO

SOUTH AMERICA
- ARGENTINA
- BOLIVIA
- CHILE
- COLOMBIA
- ECUADOR
- PARAGUAY
- PERU
- URUGUAY
- VENEZUELA

ANTARCTICA

EUROPE
- ARMENIA
- BELGIUM
- BOSNIA
- BULGARIA
- CROATIA
- DENMARK
- ESTONIA
- FINLAND
- FRANCE
- GERMANY
- HUNGARY
- ITALY
- LITHUANIA
- MACEDONIA
- MOLDOVA
- NETHERLANDS
- NORWAY
- POLAND
- ROMANIA
- RUSSIA
- SERBIA-MONTENEGRO
- SWEDEN
- SWITZERLAND
- UKRAINE
- UNITED KINGDOM

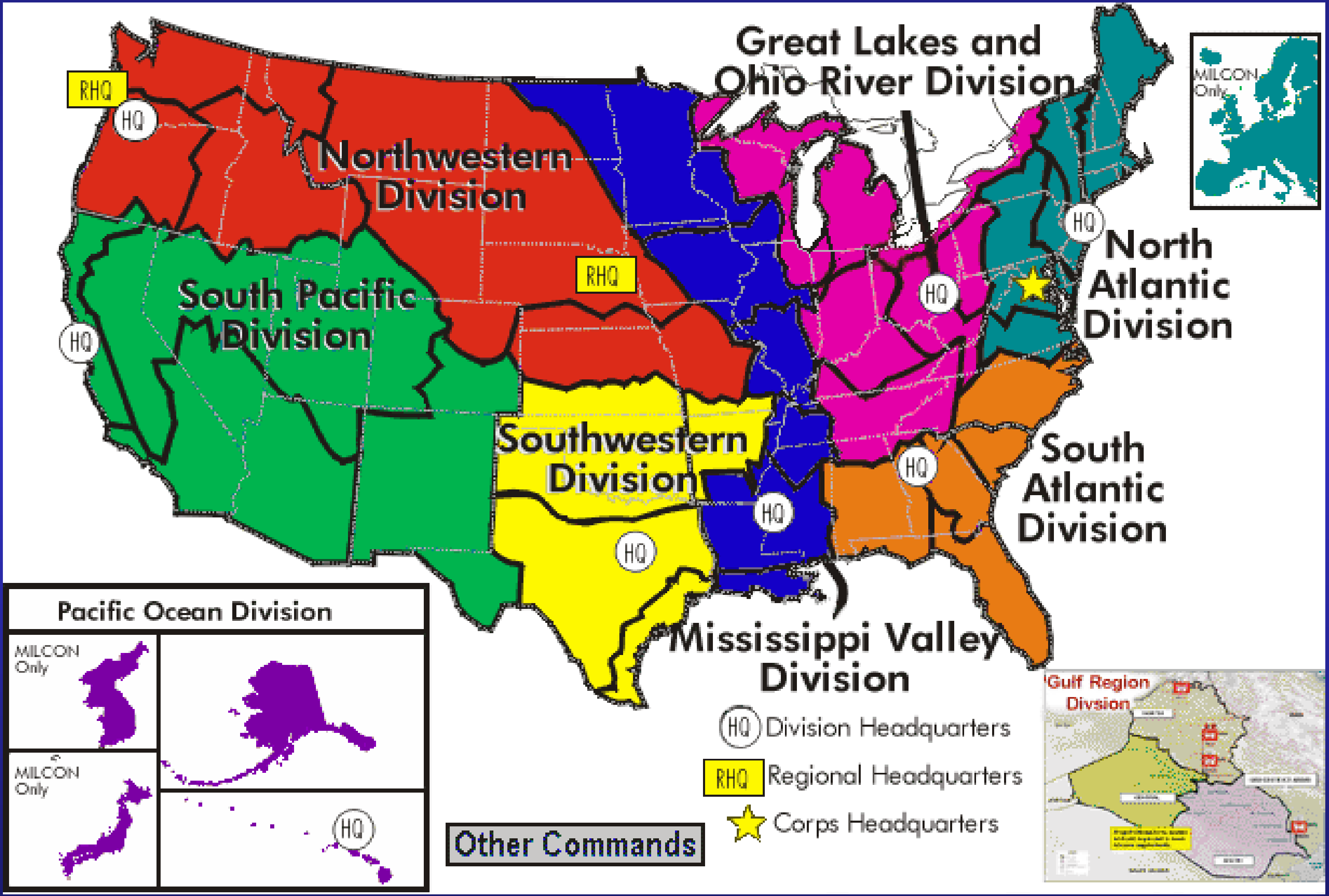
ASIA
- AFGHANISTAN
- AZERBAIJAN
- BAHRAIN
- CHINA
- GEORGIA
- INDIA
- IRAQ
- ISRAEL
- JAPAN
- JORDAN
- KAZAKHSTAN
- KUWAIT
- KYRGYZSTAN
- OMAN
- PHILIPPINES
- QATAR
- SAUDI ARABIA
- SOUTH KOREA
- TAJIKISTAN
- THAILAND
- TURKEY
- U.A.E.
- VIETNAM

AFRICA
- CAPE VERDE
- CAMEROON
- CHAD
- DJIBOUTI
- EGYPT
- ERITREA
- GHANA
- KENYA
- MADAGASCAR
- MALI
- MOZAMBIQUE
- NIGER
- NIGERIA
- RWANDA
- SENEGAL
- SOUTH AFRICA

AUSTRALIA
NEW ZEALAND

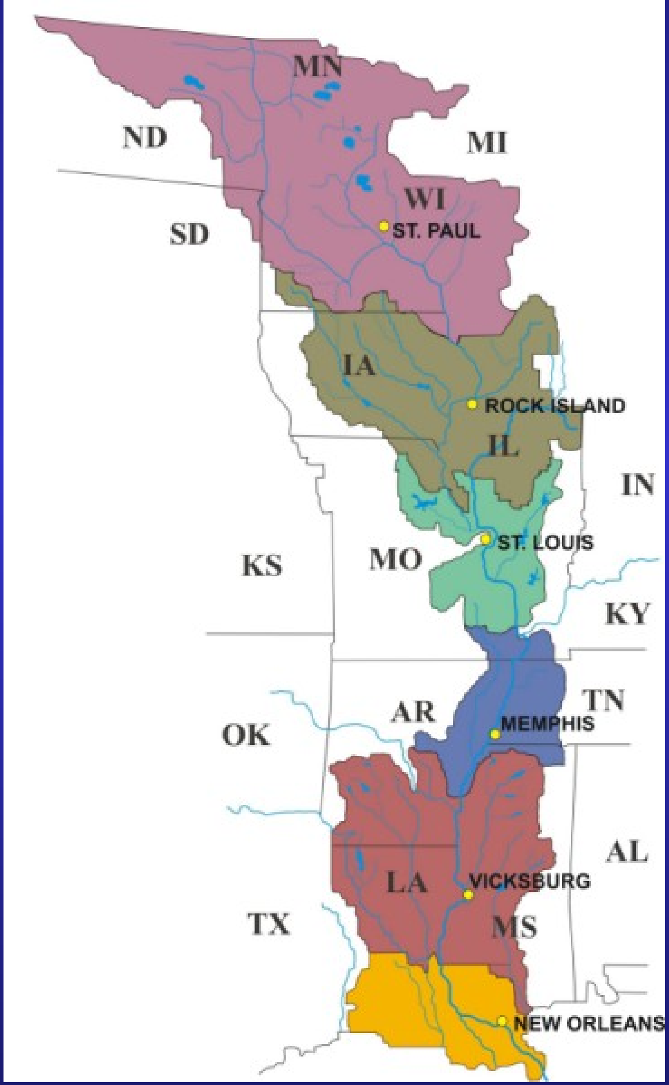
OCEANIA
- AM. SAMOA
- EAST TIMOR
- GUAM
- MICRONESIA
- MARSHALL ISL
- N. MARIANA ISL
- REP. OF PALAU

U.S. Army Corps of Engineers Divisions


RHQ
HQ
Northwestern Division
South Pacific Division
HQ
RHQ
Great Lakes and Ohio River Division
MILCON Only
HQ
North Atlantic Division
HQ
Southwestern Division
HQ
HQ
HQ
South Atlantic Division
Mississippi Valley Division
Pacific Ocean Division
MILCON Only
MILCON Only
HQ
Other Commands
HQ Division Headquarters
RHQ Regional Headquarters
☆ Corps Headquarters
Gulf Region Division

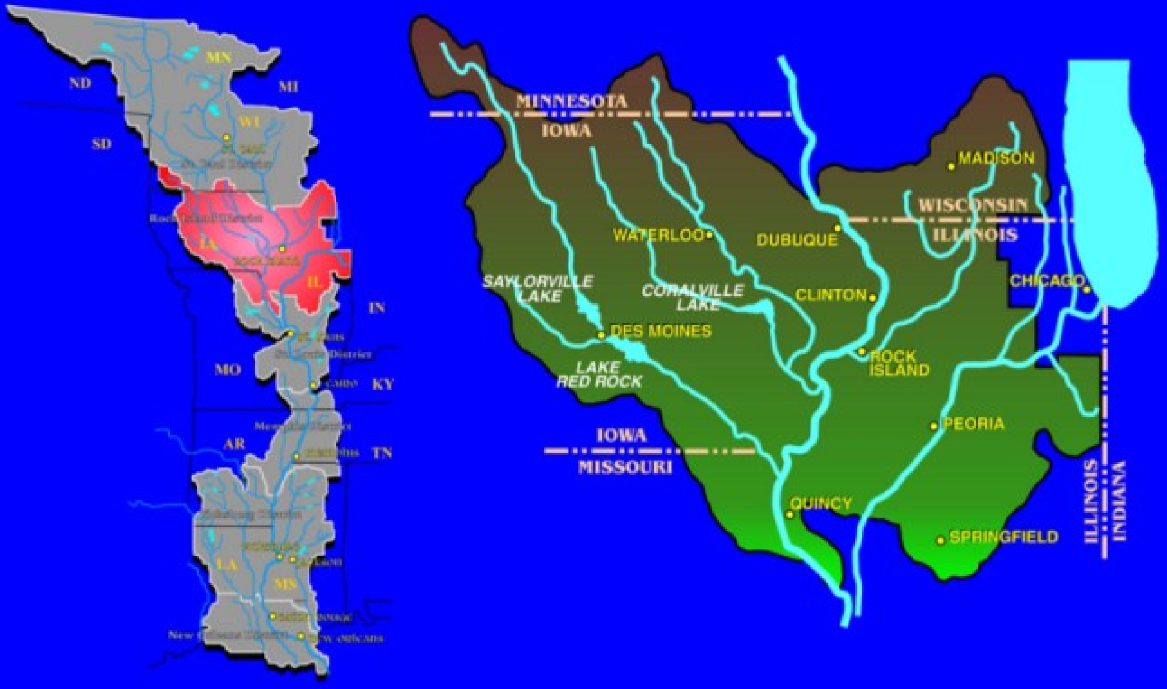
US Army Corps of Engineers ®

Mississippi Valley Division


MN
ND
MI
WI
ST. PAUL
SD
IA
ROCK ISLAND
IL
IN
ST. LOUIS
KS
MO
KY
TN
AR
MEMPHIS
OK
AL
LA
VICKSBURG
TX
MS
NEW ORLEANS

- Six districts
- 5,000+ employees
- 370,000 square miles
- 4,267 miles of commercial waterways
- 44 flood control reservoirs

Rock Island District


ND
MN
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St. Paul
St. Paul District
Rock Island District
IA
Rock Island
IL
IN
St. Louis
St. Louis District
MO
Cairo
KY
Memphis District
AR
Memphis
TN
Vicksburg District
Vicksburg
Jackson
LA
MS
Baton Rouge
New Orleans District
New Orleans
MINNESOTA
IOWA
MADISON
WISCONSIN
ILLINOIS
WATERLOO
DUBUQUE
SAYLORVILLE LAKE
CORALVILLE LAKE
CLINTON
CHICAGO
DES MOINES
LAKE RED ROCK
ROCK ISLAND
PEORIA
IOWA
MISSOURI
QUINCY
SPRINGFIELD
ILLINOIS
INDIANA

- Primarily a civil works district
- 78,000 square miles
- Portions of 5 states
- Operate 582 miles of 9-foot navigation channel
- 20 lock and dam sites
- 5 flood control reservoirs
- 900 employees

TASK FORCE HOPE

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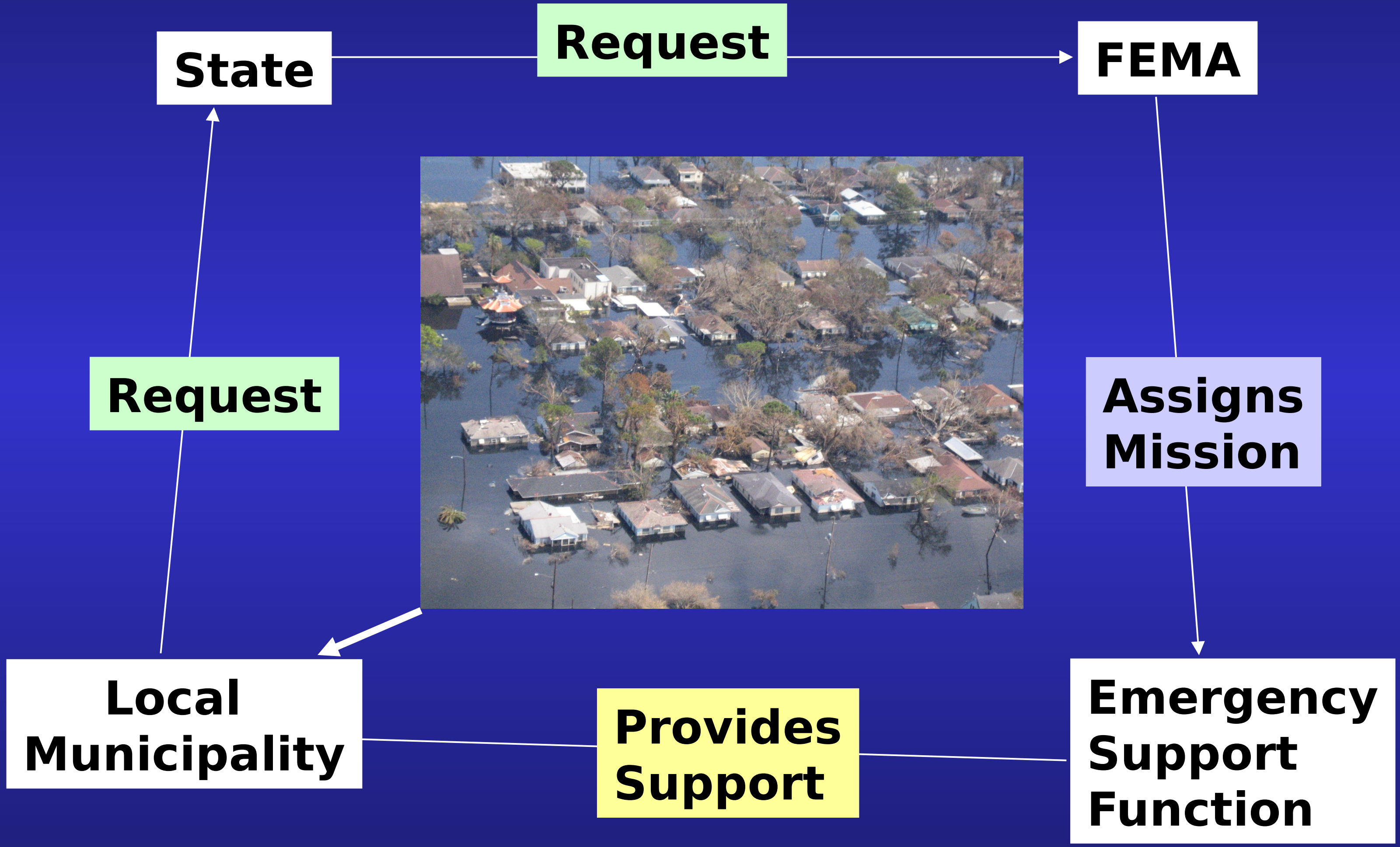
National Response Plan



State

Request

FEMA

Assigns Mission

Emergency Support Function

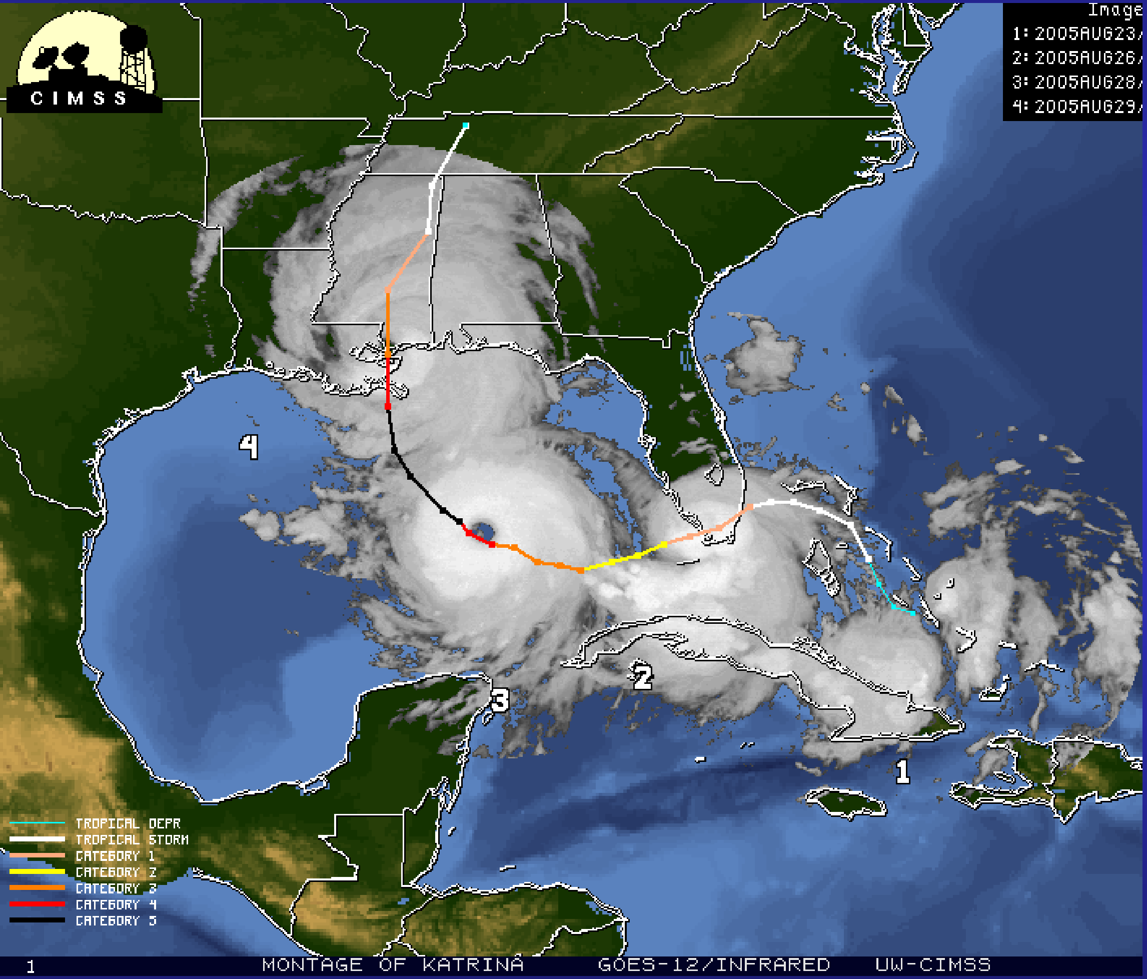
Provides Support

Local Municipality

Request

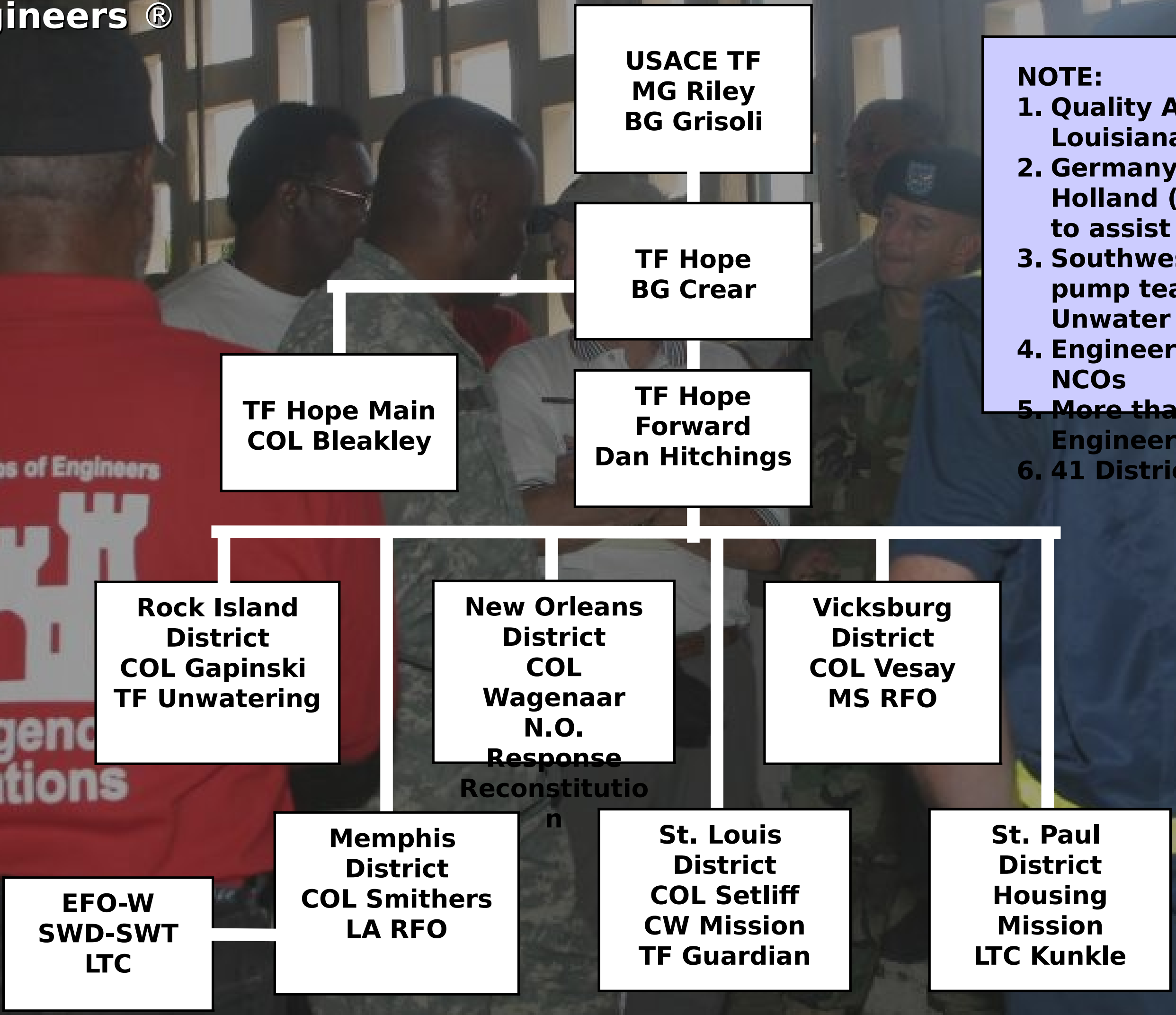
US Army Corps
of Engineers ®

Hurricane Katrina


CIMSS
Image
1: 2005AUG23/
2: 2005AUG26/
3: 2005AUG28/
4: 2005AUG29/
4
2
3
1
TROPICAL DEPR
TROPICAL STORM
CATEGORY 1
CATEGORY 2
CATEGORY 3
CATEGORY 4
CATEGORY 5
1
MONTAGE OF KATRINA
GOES-12/INFRARED
UW-CIMSS

- One of America's largest natural disasters
- More than 1,300 dead
- 127 MPH wind at landfall
- Maximum surge of 28 to 30 feet along Mississippi coast
- 51.9 million CY of debris (Louisiana and Mississippi)
- 80 percent of New Orleans flooded
- $96B in damages

Organization



USACE TF
MG Riley
BG Grisoli

TF Hope
BG Crear

TF Hope Main
COL Bleakley

TF Hope
Forward
Dan Hitchings

Rock Island
District
COL Gapinski
TF Unwatering

New Orleans
District
COL
Wagenaar
N.O.
Response
Reconstruction

Vicksburg
District
COL Vesay
MS RFO

EFO-W
SWD-SWT
LTC

Memphis
District
COL Smithers
LA RFO

St. Louis
District
COL Setliff
CW Mission
TF Guardian

St. Paul
District
Housing
Mission
LTC Kunkle

NOTE:
1. Quality Assurance augmentation to Louisiana and Mississippi RFOs
2. Germany (70), Luxembourg (9), & Holland (4) - provided pump teams to assist Task Force Unwater
3. Southwestern Division provided a pump team to assist Task Force Unwater
4. Engineer School - 20 officers and NCOs
5. More than 10% of the Corps of Engineers
6. 41 Districts, 8 Divisions, 4 Centers

Mission

Task Force Hope mission areas are:

- Support to Federal Emergency Management Agency
    - Unwatering
    - ESF3 Tasks (ice, water, power, debris removal, temporary roofing, technical assistance)
- Department of Defense response
    - Joint Task Force Katrina
- Inherent Corps of Engineers missions
    - Flood control
    - Navigation
    - Civil works projects
- Reconstitute New Orleans District

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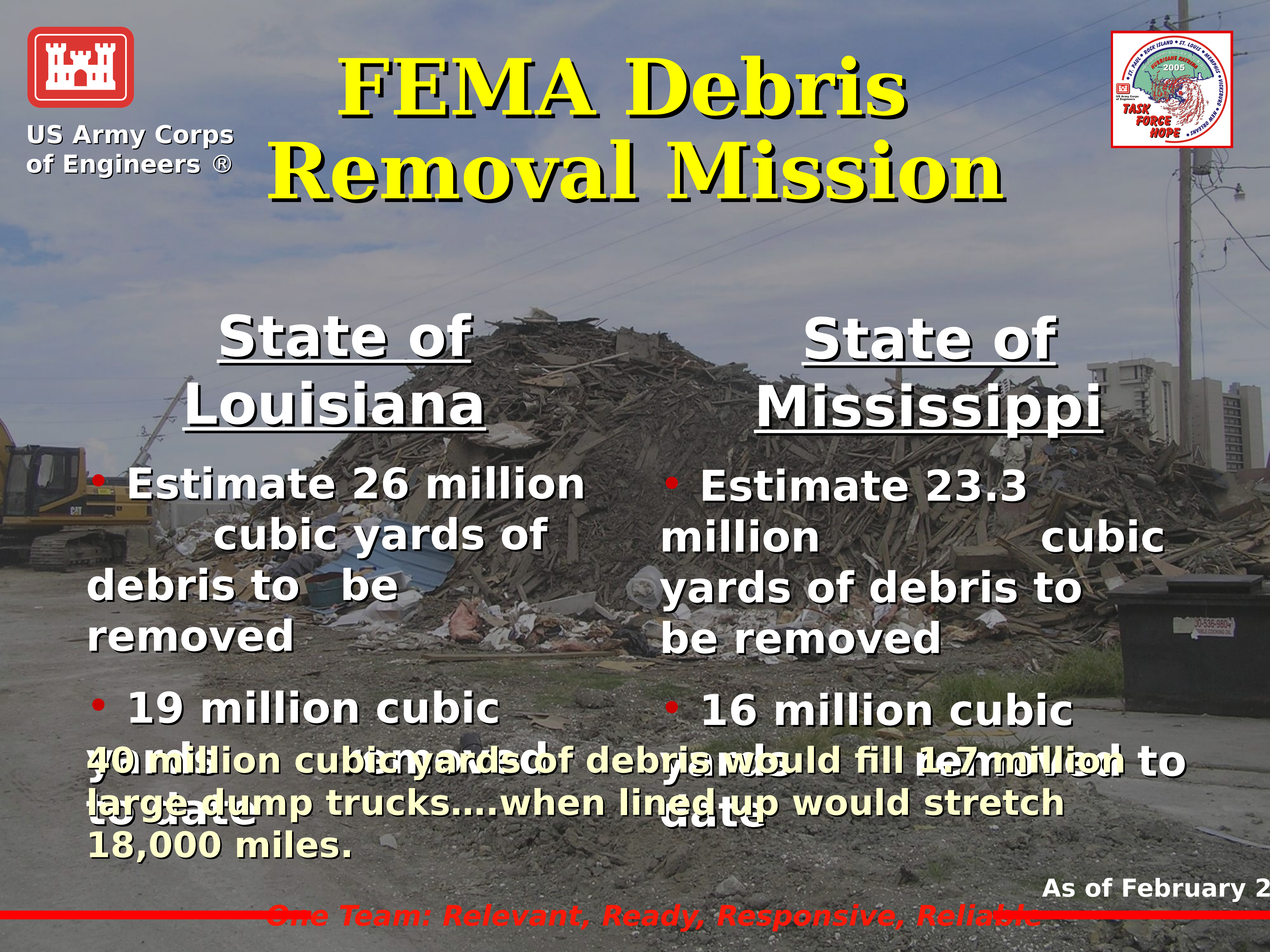
Mission Status

Sustain Lives

- National Response Plan
  - Advance contracts with commodity suppliers
  - Pre-positioned in staging areas
  - Final distribution through local governments
- Water Delivery
  - More than 3,100 truckloads delivered
  - One truckload is ~18,000 liters (serves 3,600)
- Ice Delivery
  - 2,833 truckloads delivered
  - One ice truck = 40,000 lbs of ice, 5 lbs per person (serves 8,000)

Mission Status
Sustain Lives

- Emergency Generators for Critical Public Facilities
  - Hospitals
  - Government buildings
  - Recovery team facilities
- Support Provided
  - 1,337 power assessments completed
  - 418 power installations completed



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FEMA Debris Removal Mission

State of Louisiana

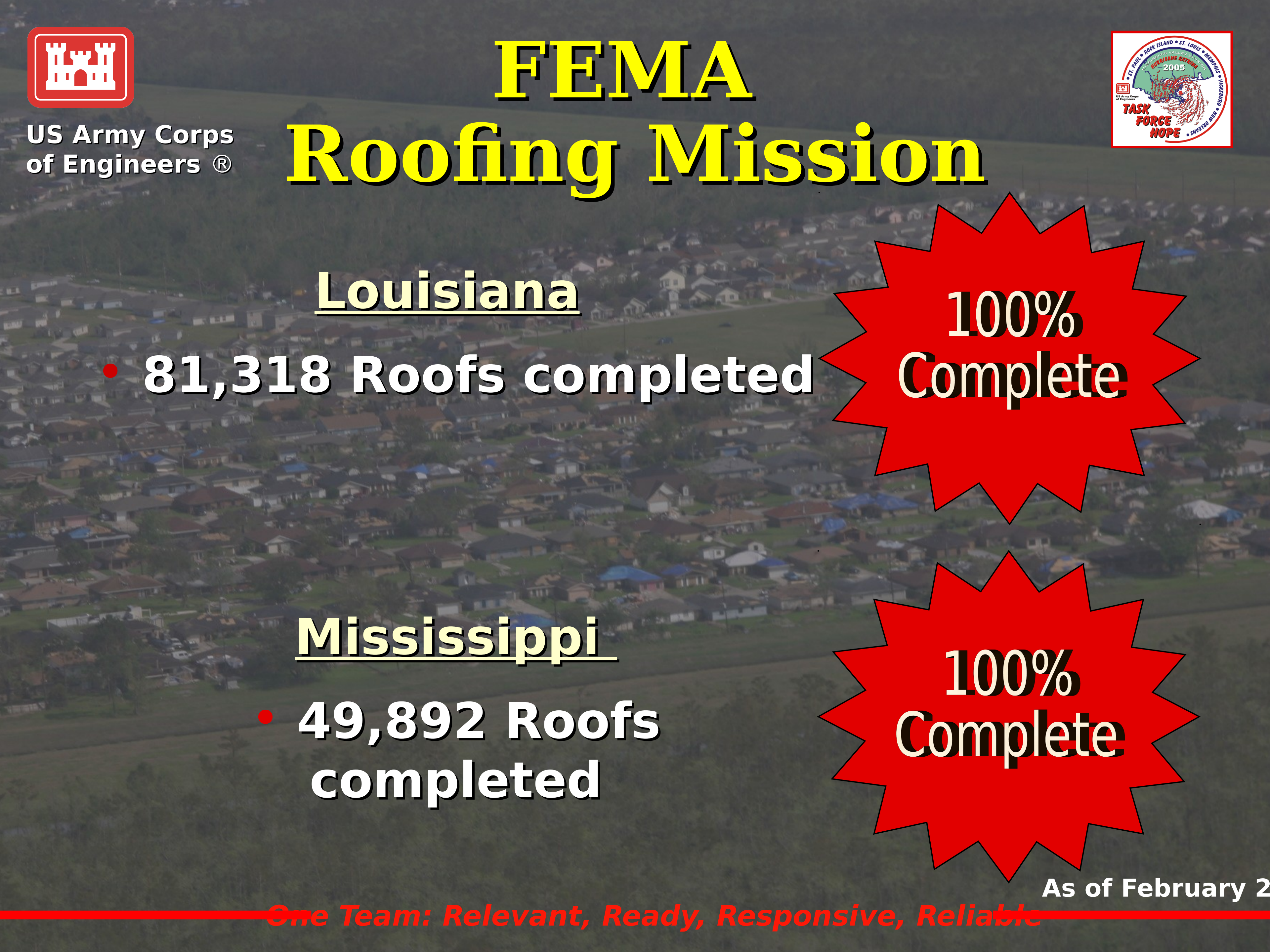
- Estimate 26 million cubic yards of debris to be removed
- 19 million cubic yards removed to date

State of Mississippi

- Estimate 23.3 million cubic yards of debris to be removed
- 16 million cubic yards removed to date

40 million cubic yards of debris would fill 1.7 million large dump trucks….when lined up would stretch 18,000 miles.

As of February 2



FEMA Roofing Mission

Louisiana

- 81,318 Roofs completed

100% Complete

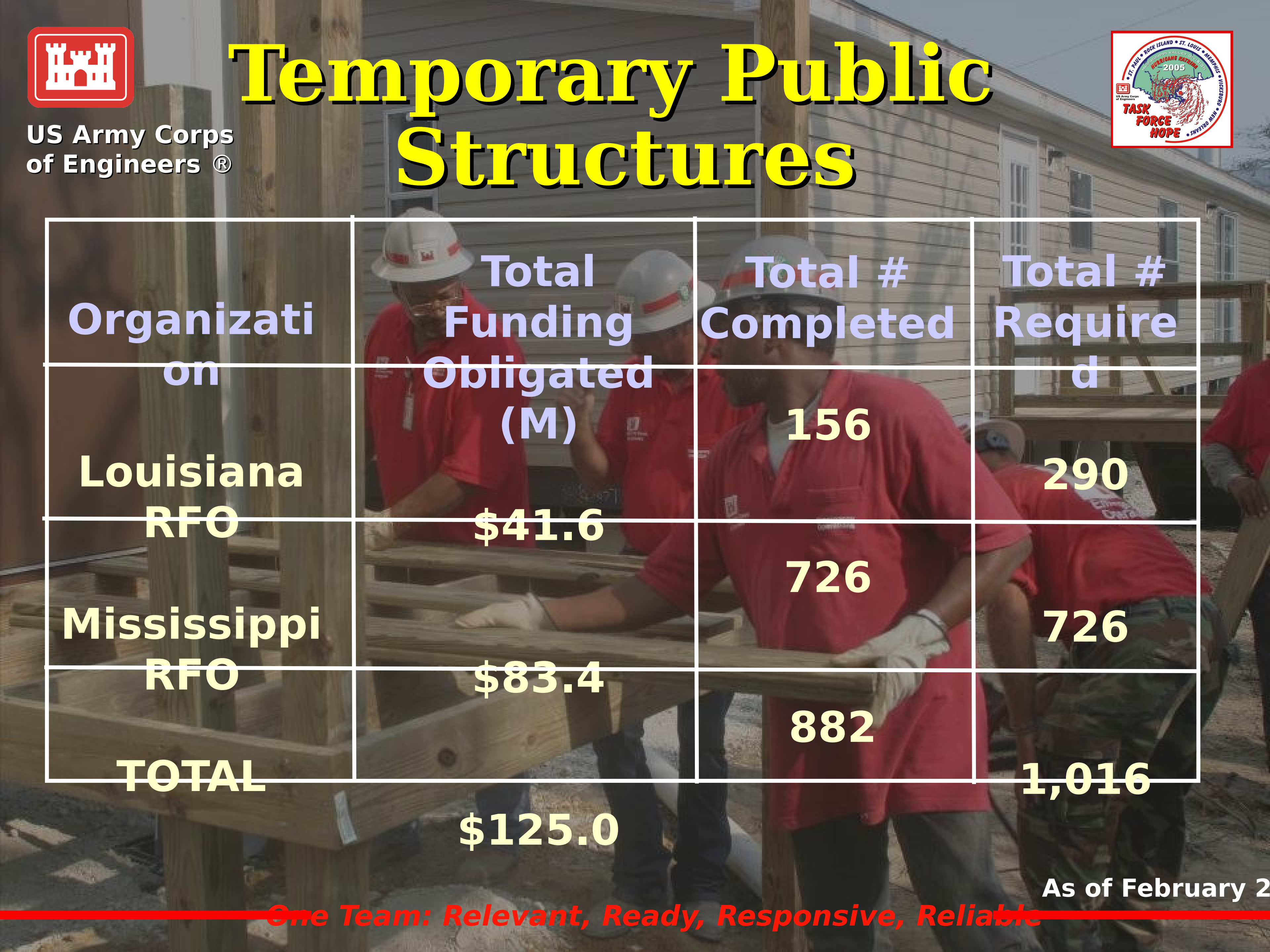
Mississippi

- 49,892 Roofs completed

100% Complete

As of February 2

Temporary Public Structures



Organization	Total Funding Obligated (M)	Total # Completed	Total # Required
Louisiana RFO	$41.6	156	290
Mississippi RFO	$83.4	726	726
TOTAL	$125.0	882	1,016

As of February 2

The Unwatering of New Orleans

US Army Corps
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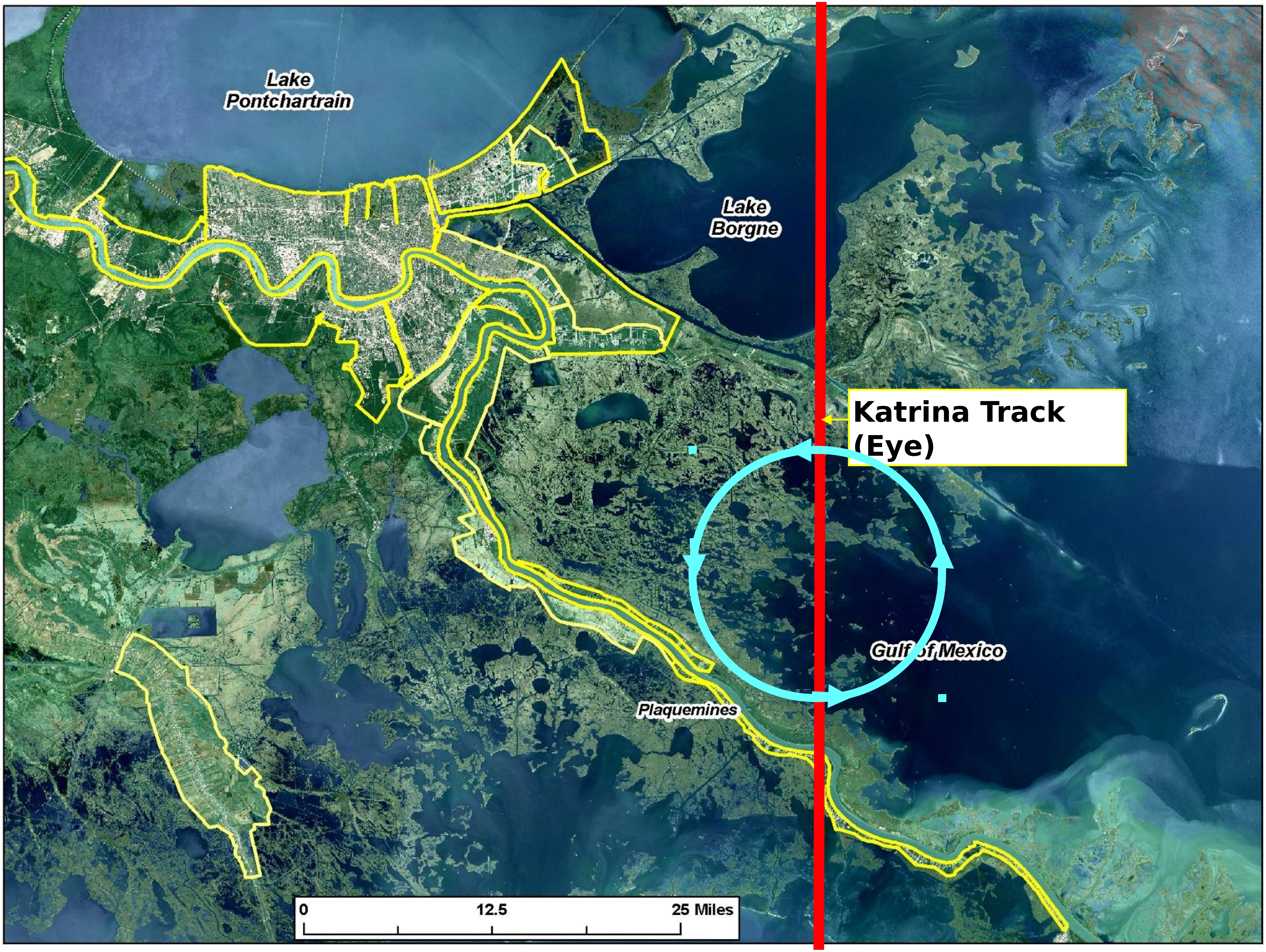
Task Force Unwatering

Mission: Unwater the areas affected by Hurricane Katrina (and later, Rita) and provide an interim level of protection so traditional recovery operations can begin



Lake Pontchartrain
Lake Borgne
Gulf of Mexico
Plaquemines
0
12.5
25 Miles

Katrina Track (Eye)

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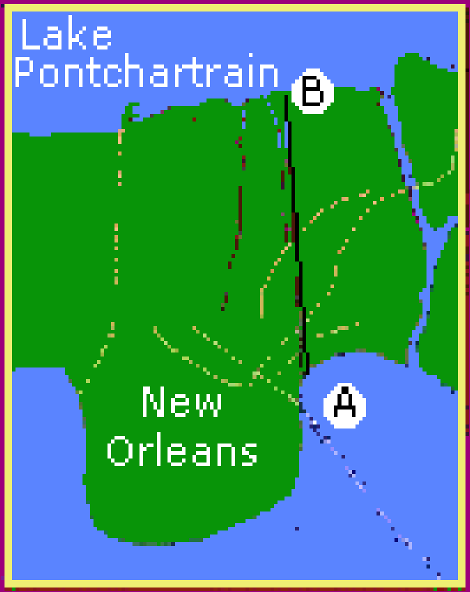
of Engineers ®

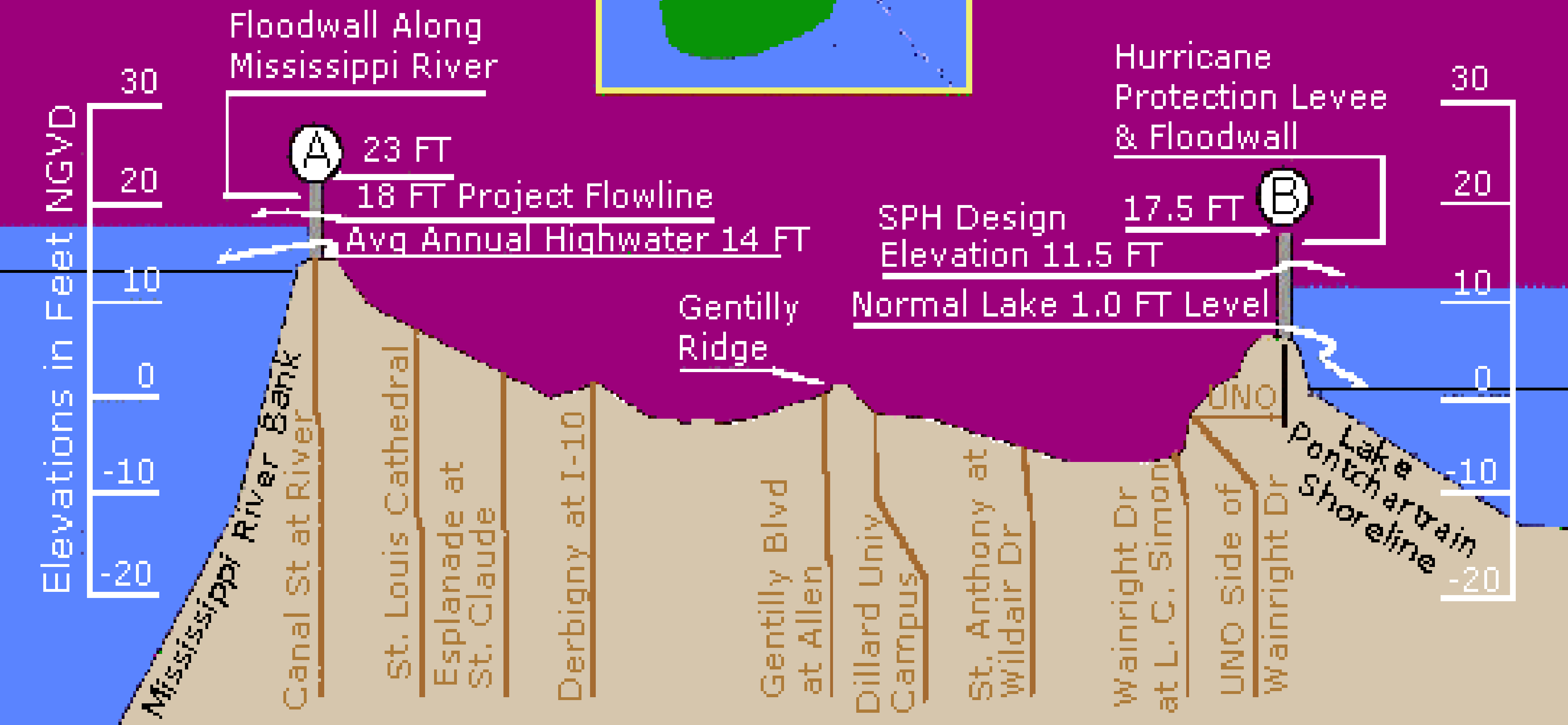
Storm Surge

City of New Orleans Ground Elevations

From Canal St. at Mississippi River to the Lakefront at U.N.O.

Area Map


Lake Pontchartrain
B
New Orleans
A


Floodwall Along Mississippi River
A
23 FT
18 FT Project Flowline
Avg Annual Highwater 14 FT
Hurricane Protection Levee & Floodwall
B
17.5 FT
SPH Design Elevation 11.5 FT
Normal Lake 1.0 FT Level
Gentilly Ridge
UNO
Elevations in Feet NGVD
30
20
10
0
-10
-20
Mississippi River Bank
Canal St at River
St. Louis Cathedral
Esplanade at St. Claude
Derbigny at I-10
Gentilly Blvd at Allen
Dillard Univ Campus
St. Anthony at Wildair Dr
Wainright Dr at L. C. Simon
UNO Side of Wainright Dr
Lake Pontchartrain Shoreline

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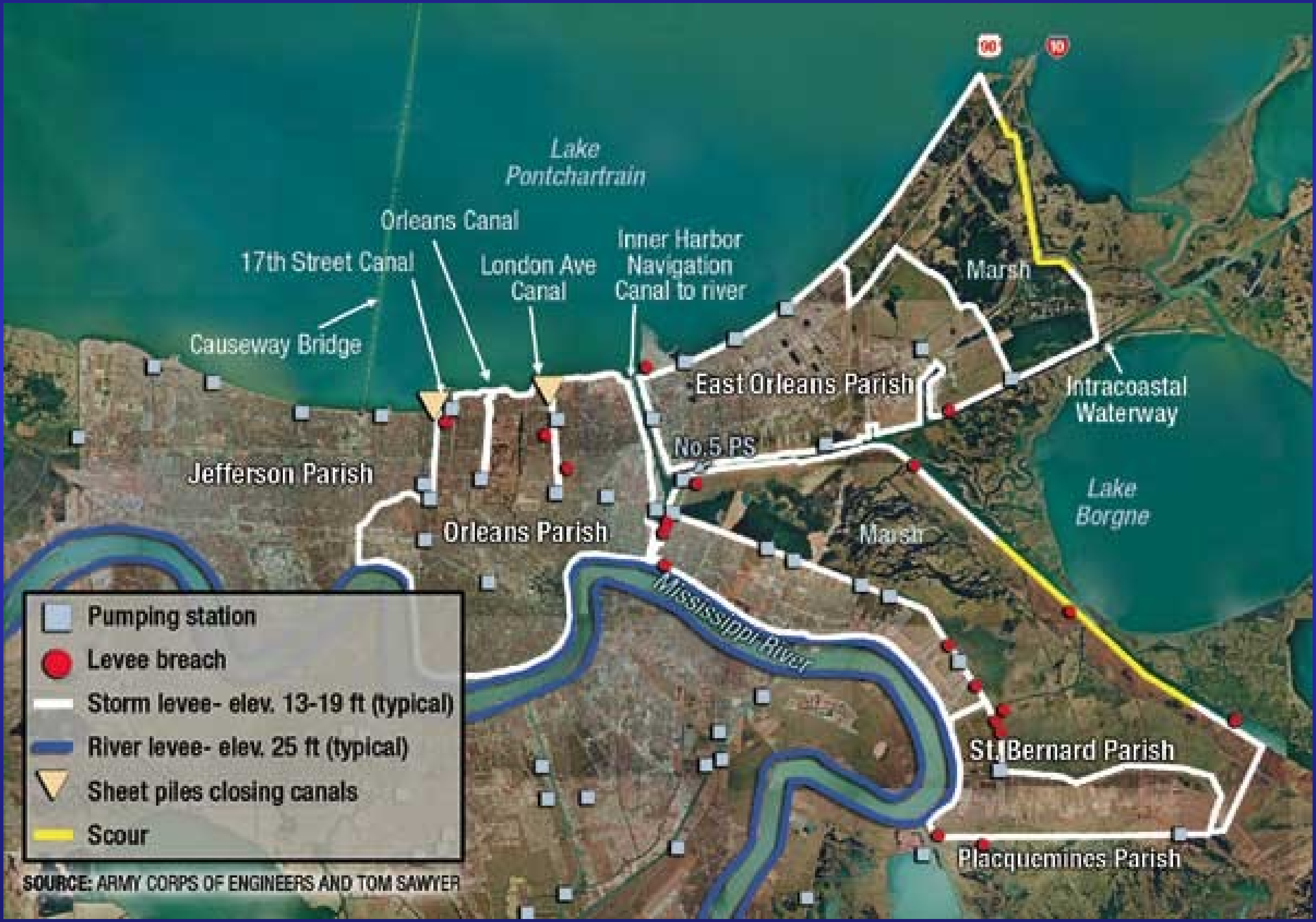
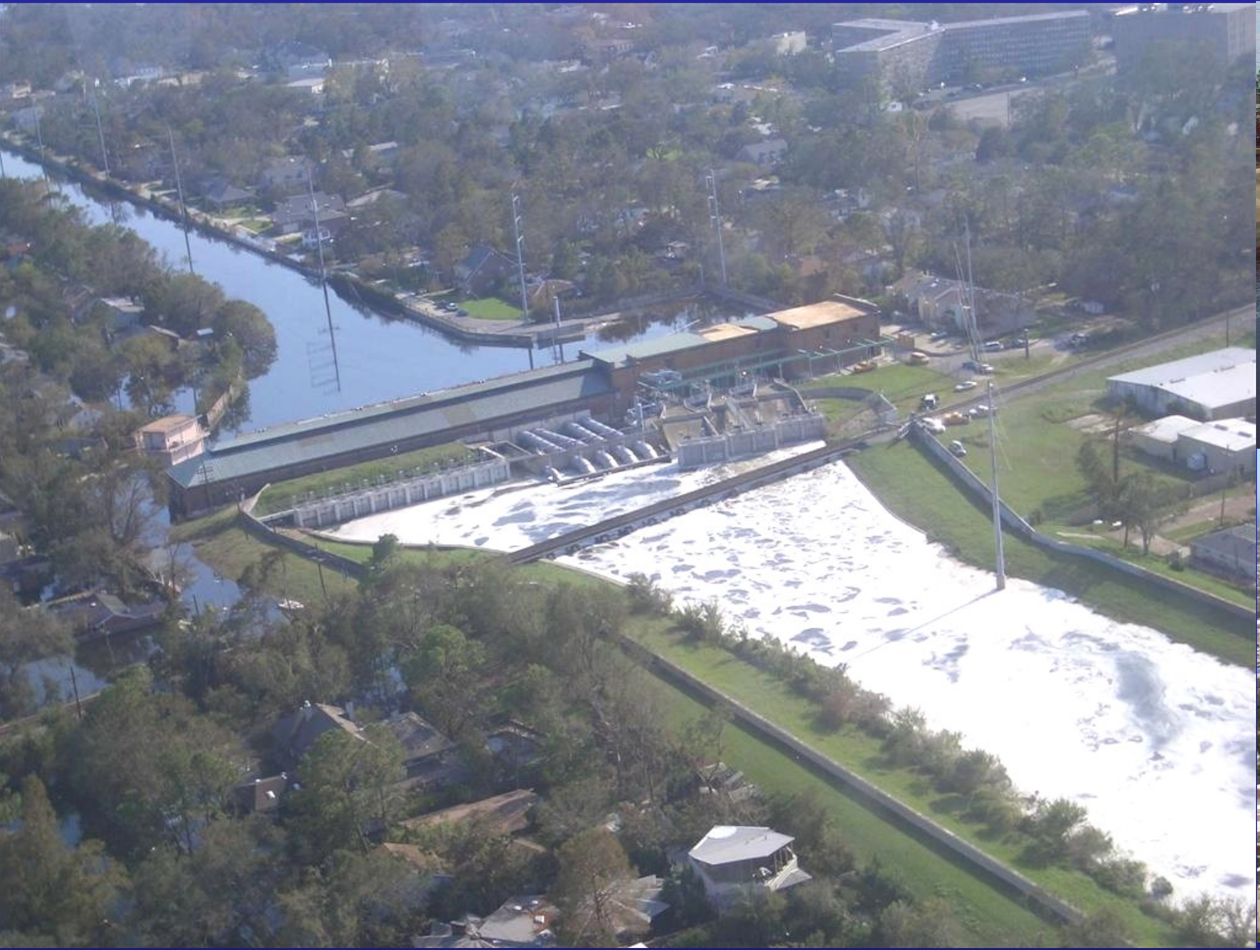
Metropolitan New Orleans


90
10
Lake Pontchartrain
Orleans Canal
17th Street Canal
London Ave Canal
Inner Harbor Navigation Canal to river
Causeway Bridge
Marsh
East Orleans Parish
Intracoastal Waterway
No.5 PS
Jefferson Parish
Orleans Parish
Lake Borgne
Marsh
Mississippi River
St. Bernard Parish
Placquemines Parish
Pumping station
Levee breach
Storm levee- elev. 13-19 ft (typical)
River levee- elev. 25 ft (typical)
Sheet piles closing canals
Scour

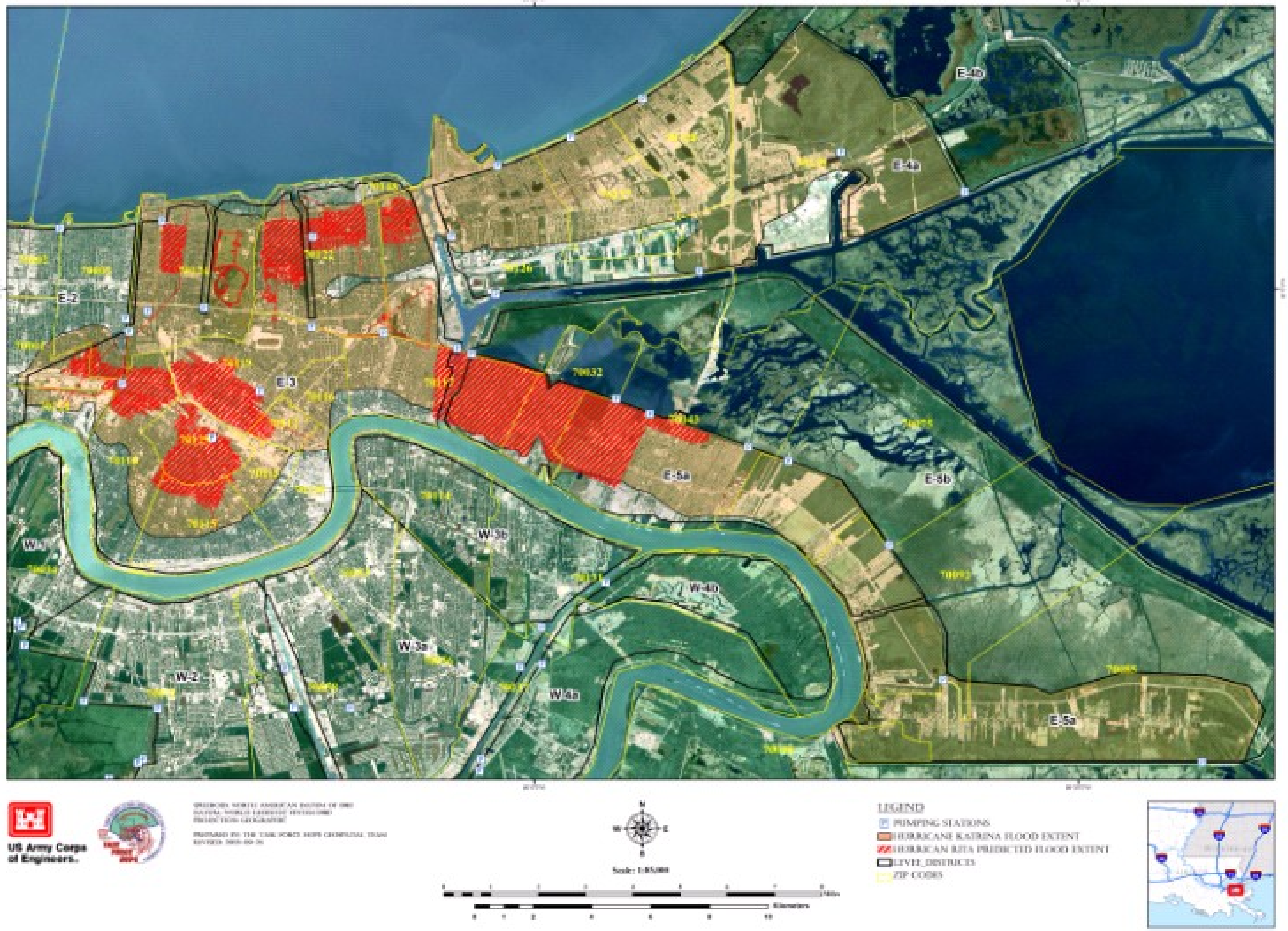
SOURCE: ARMY CORPS OF ENGINEERS AND TOM SAWYER

US Army Corps
of Engineers ®

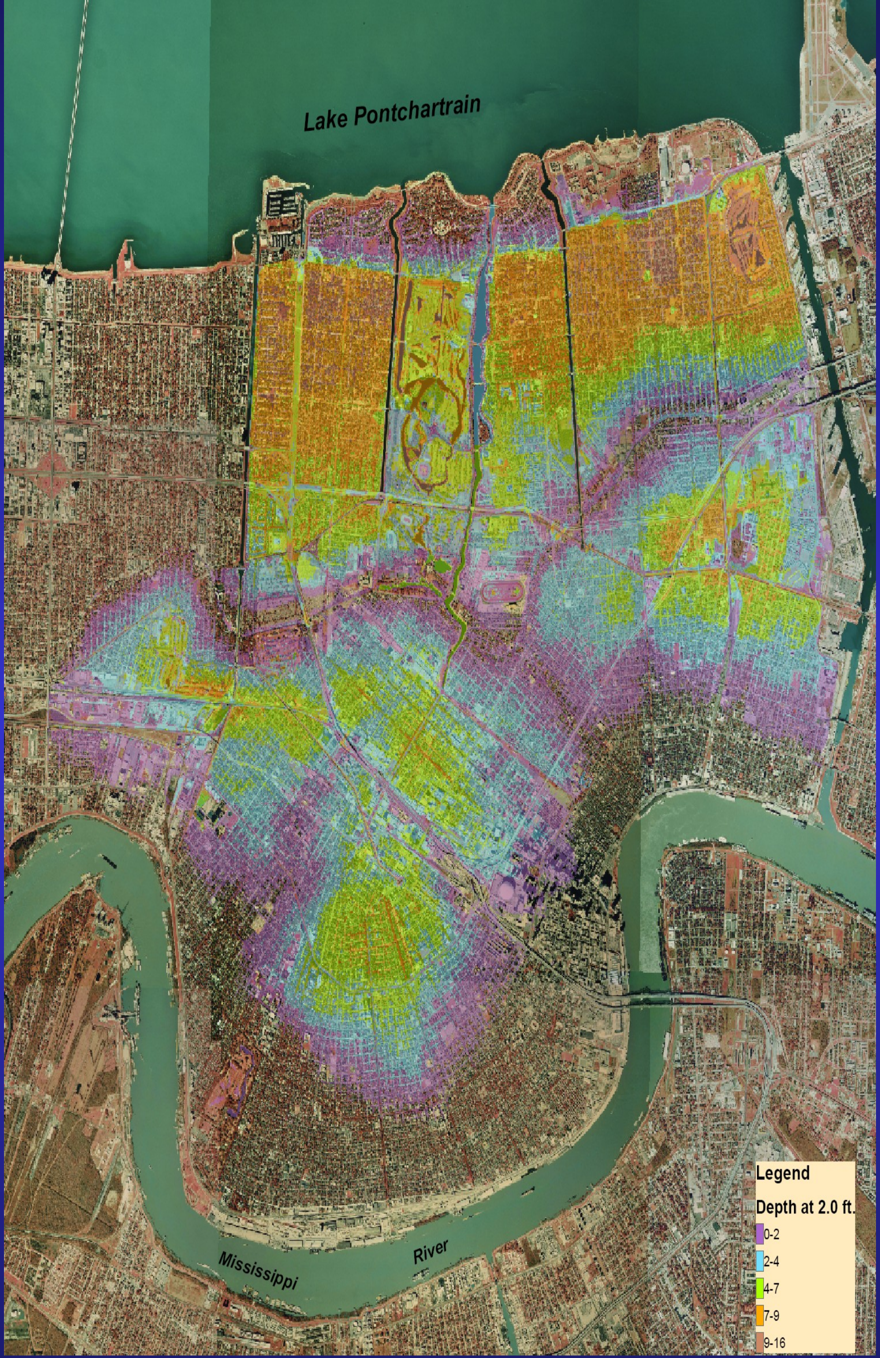
Drainage System

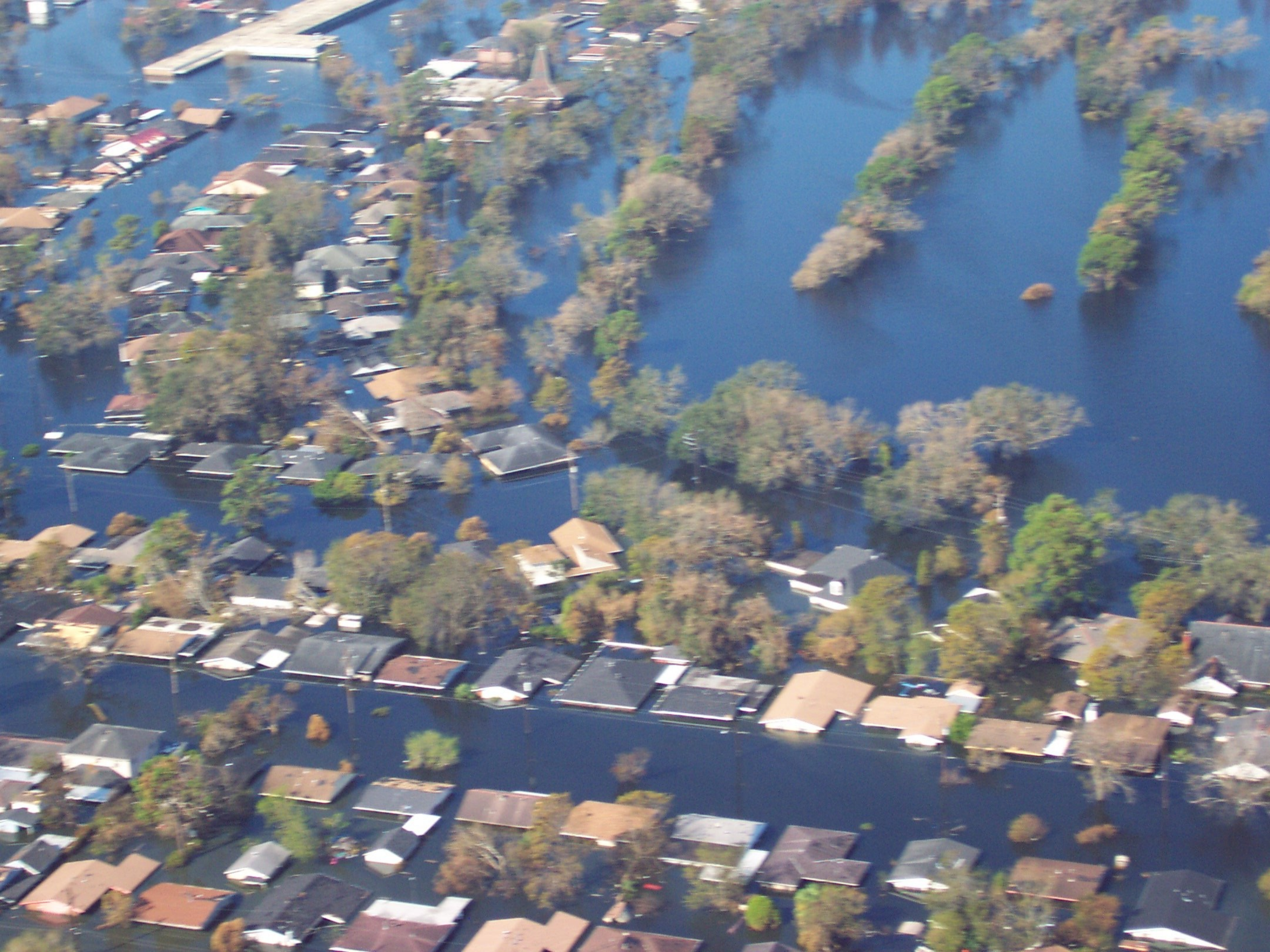


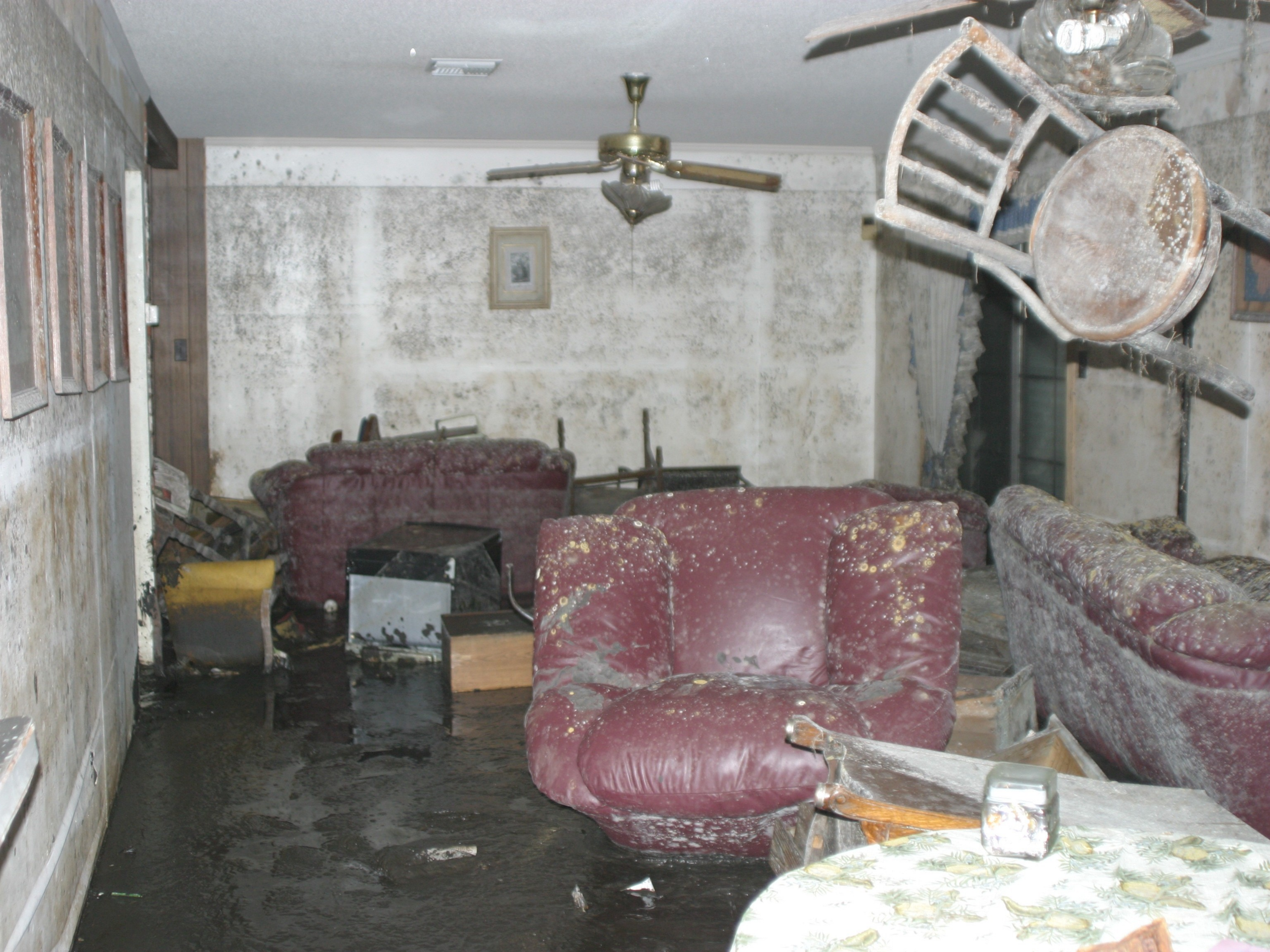
New Orleans Flooding

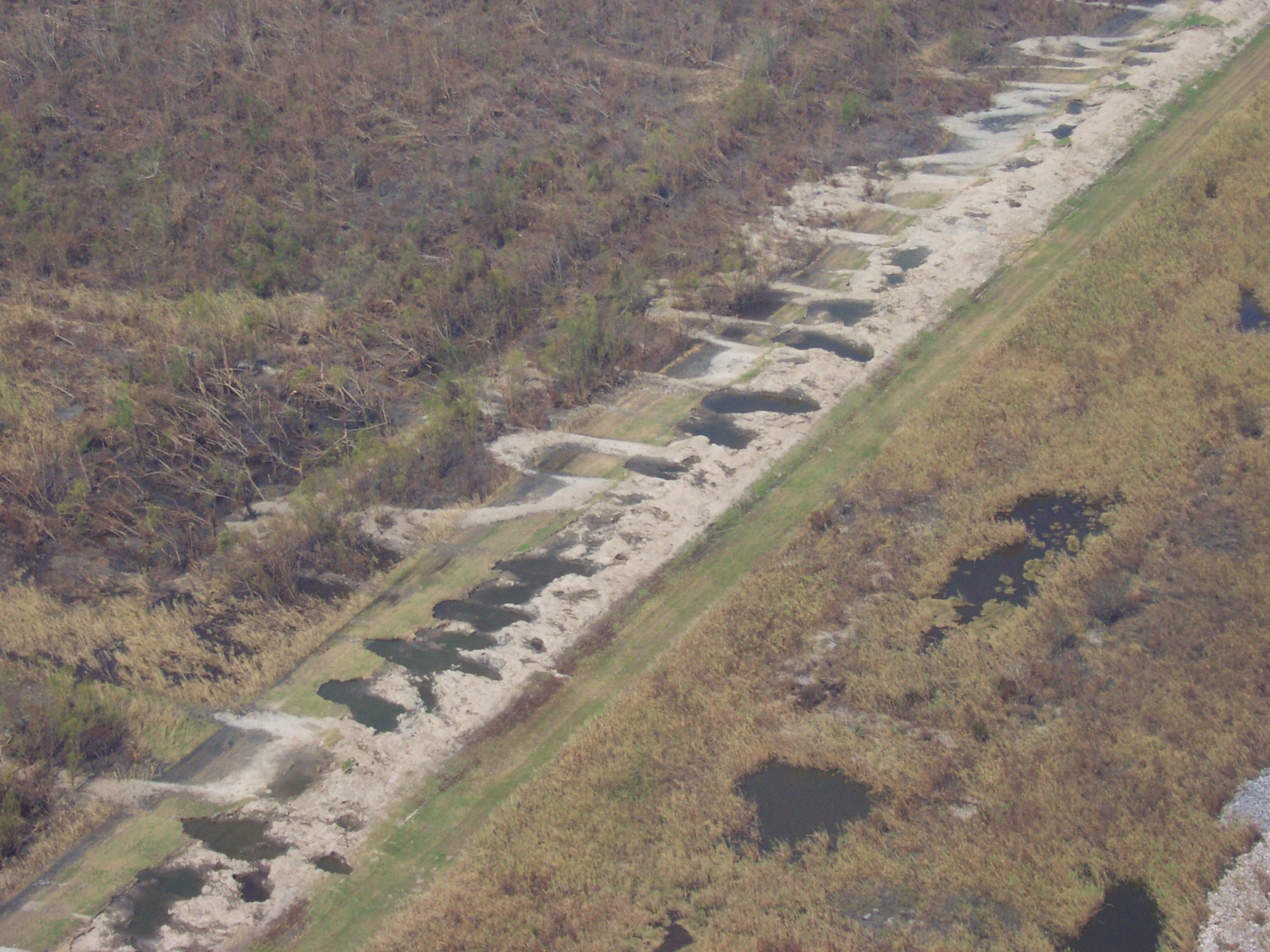

E-4b
E-4a
E-2
E-3
70032
70043
E-5a
E-5b
W-1
W-3b
W-4b
70092
W-3a
W-2
W-4a
E-5a
US Army Corps of Engineers.
PREPARED BY: THE TASK FORCE HOPE GEOSPATIAL TEAM
N
W
E
S
LEGEND
PUMPING STATIONS
HURRICANE KATRINA FLOOD EXTENT
HURRICAN RITA PREDICTED FLOOD EXTENT
LEVEE_DISTRICTS
ZIP CODES
Miles
Kilometers
0
1
2
4
6
8
10

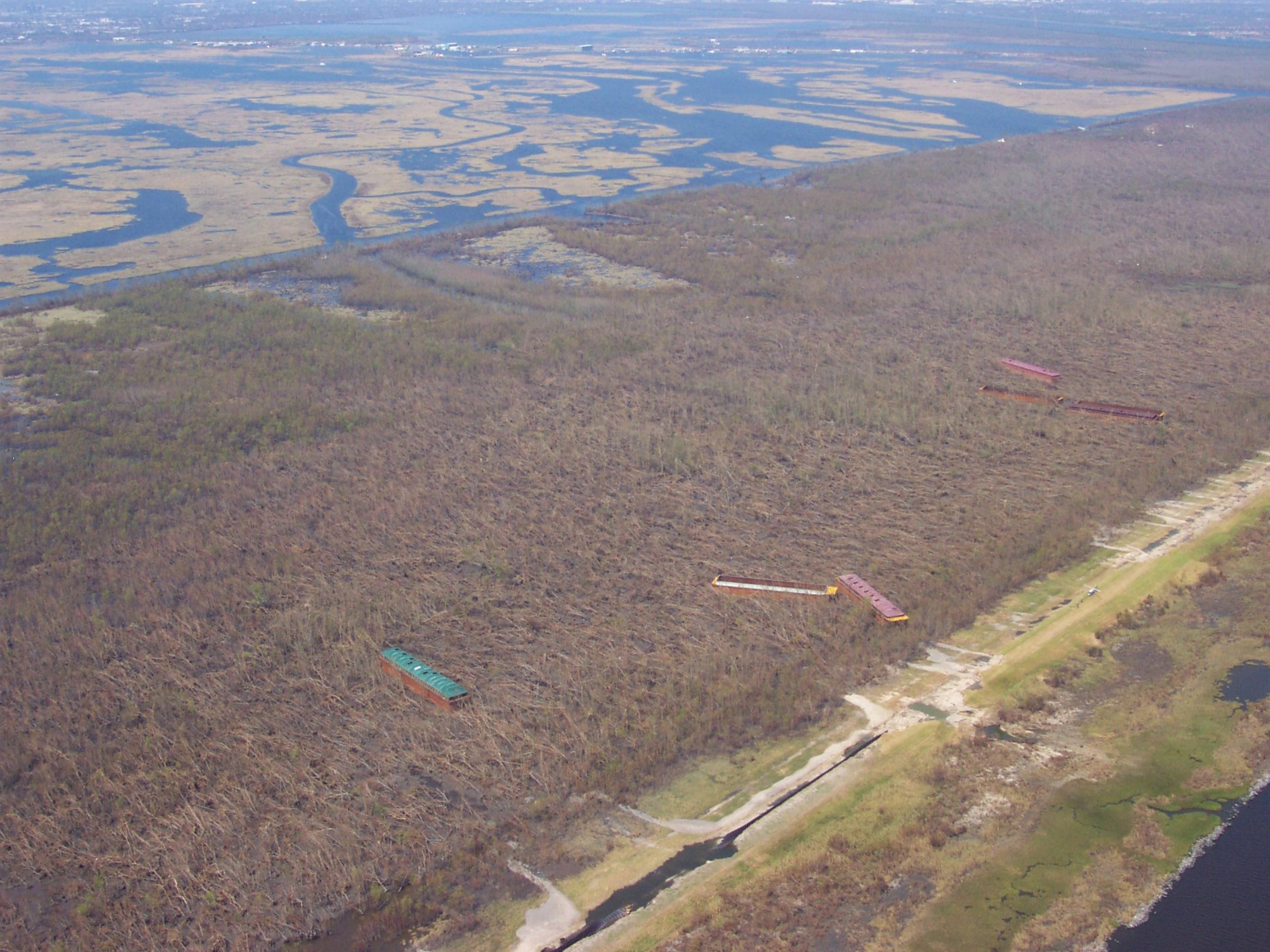
US Army Corps of Engineers ®

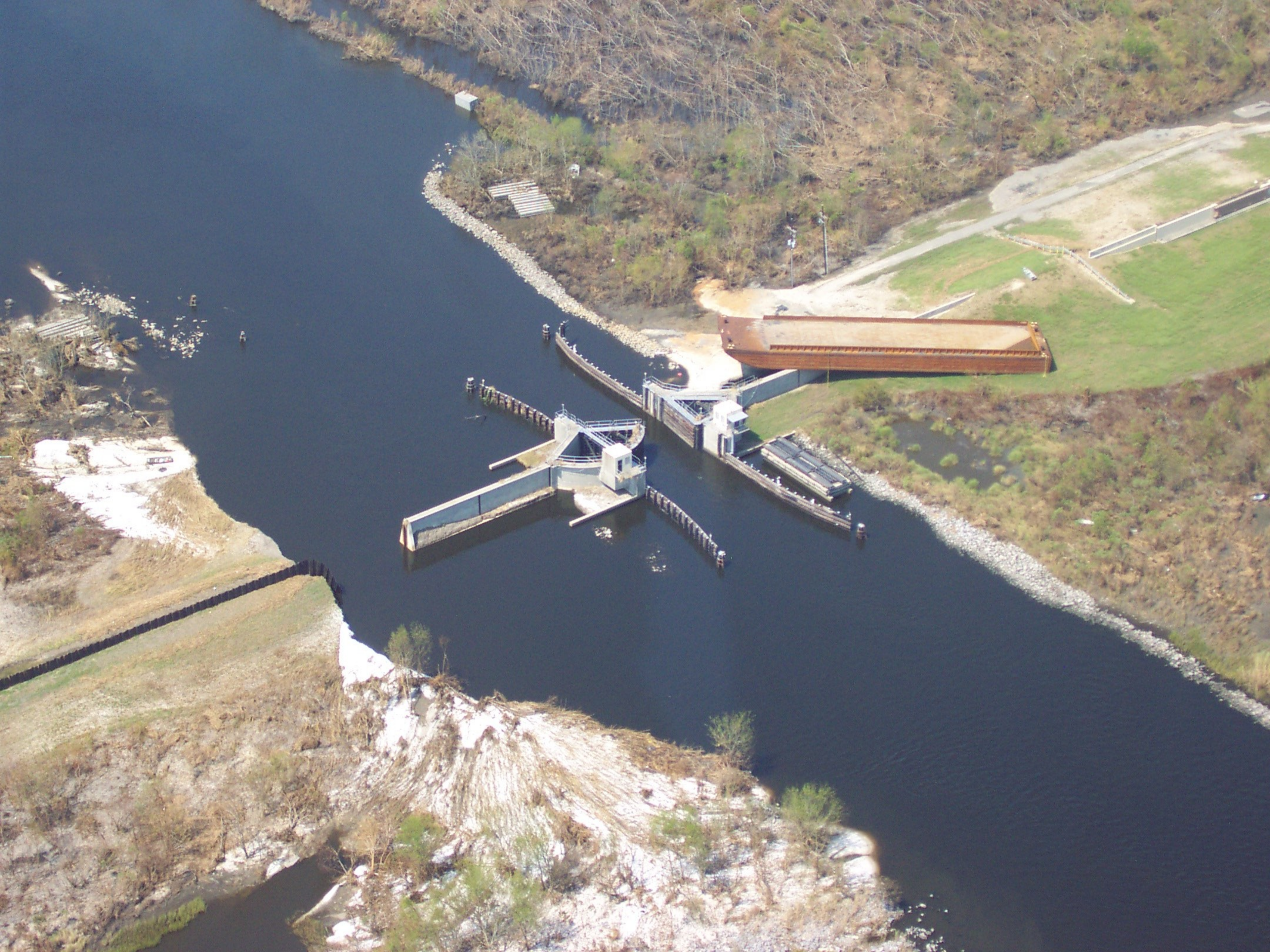

Lake Pontchartrain
Mississippi
River
Legend
Depth at 2.0 ft.
🟪 0-2
🟦 2-4
🟩 4-7
🟧 7-9
9-16

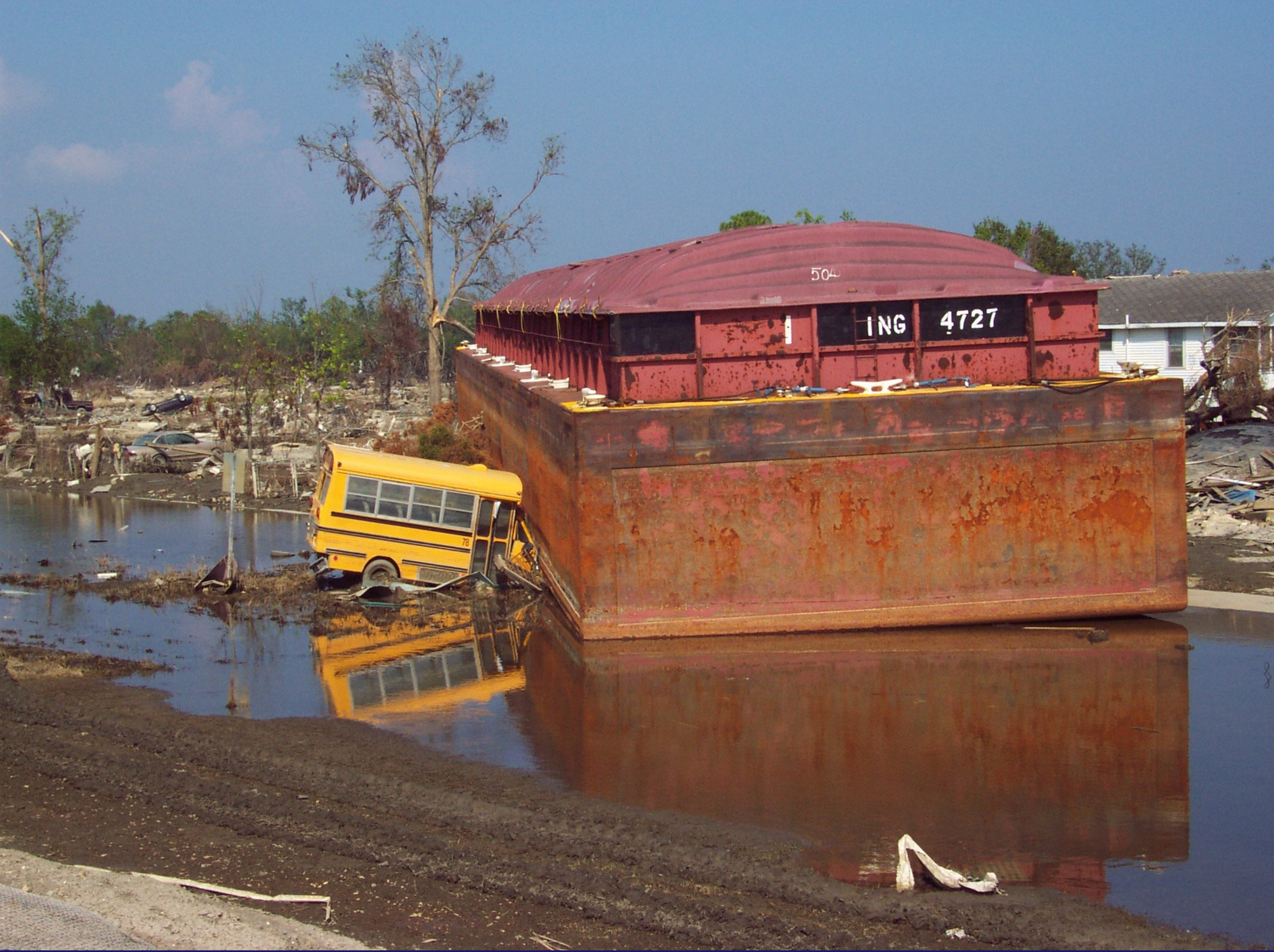








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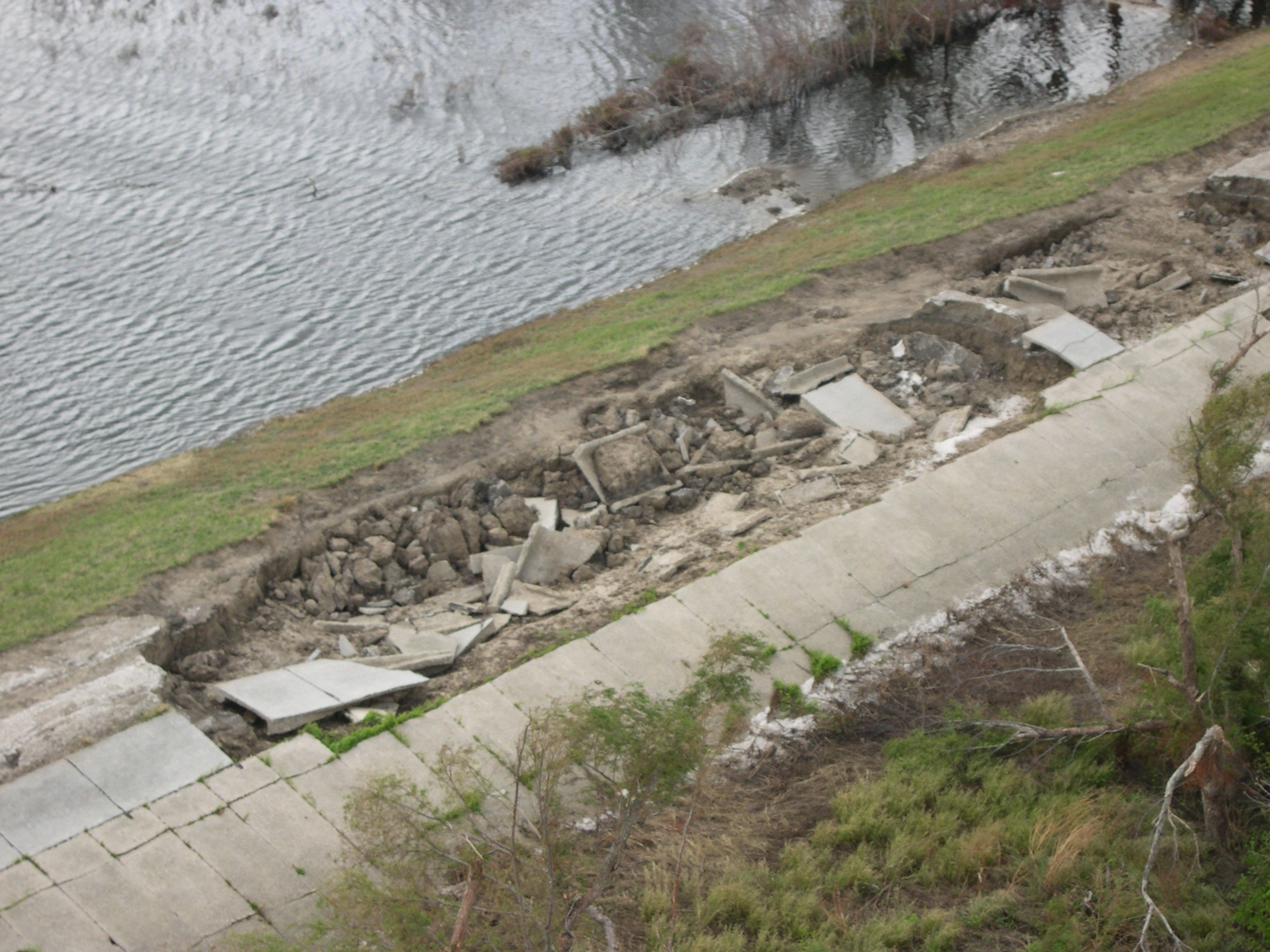
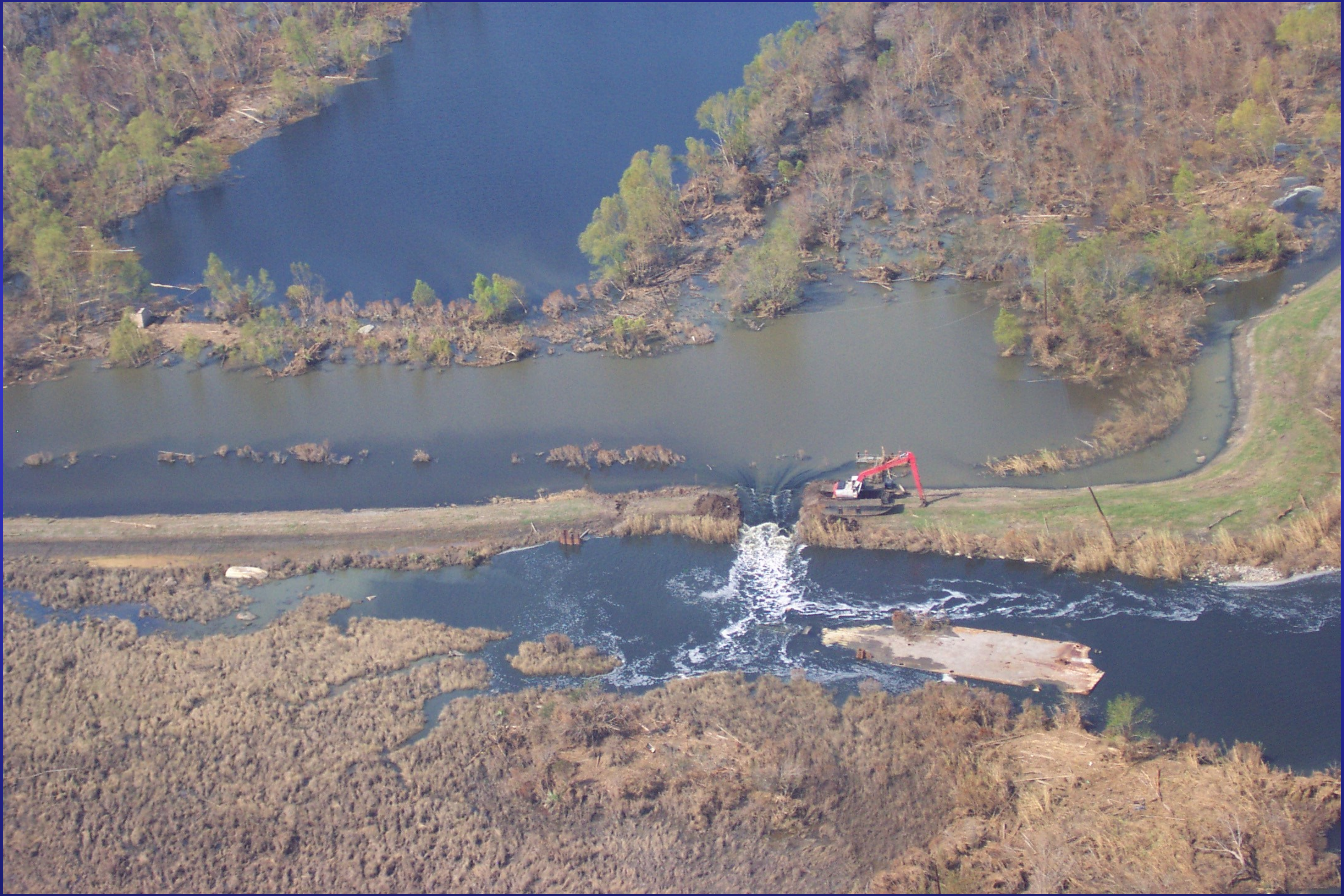


Task Force Unwatering

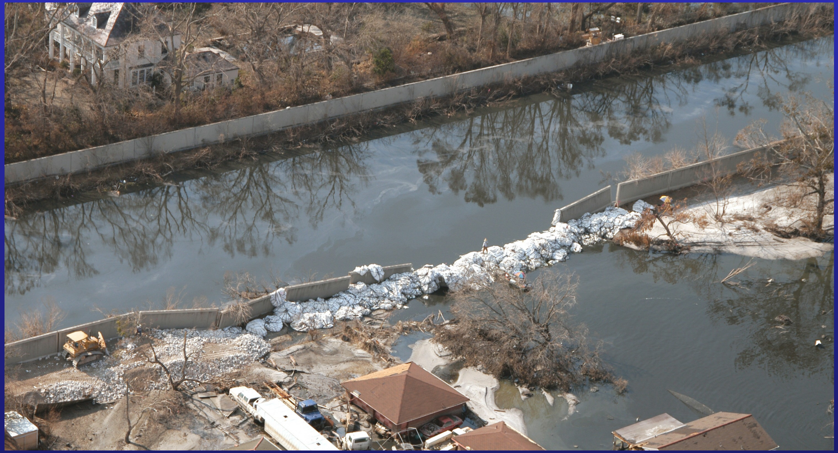
US Army Corps
of Engineers ®

Basic Strategy



Basic Strategy

US Army Corps of Engineers
Emergency Operations



US Army Corps
of Engineers ®

Basic Strategy

US Army Corps
of Engineers ®

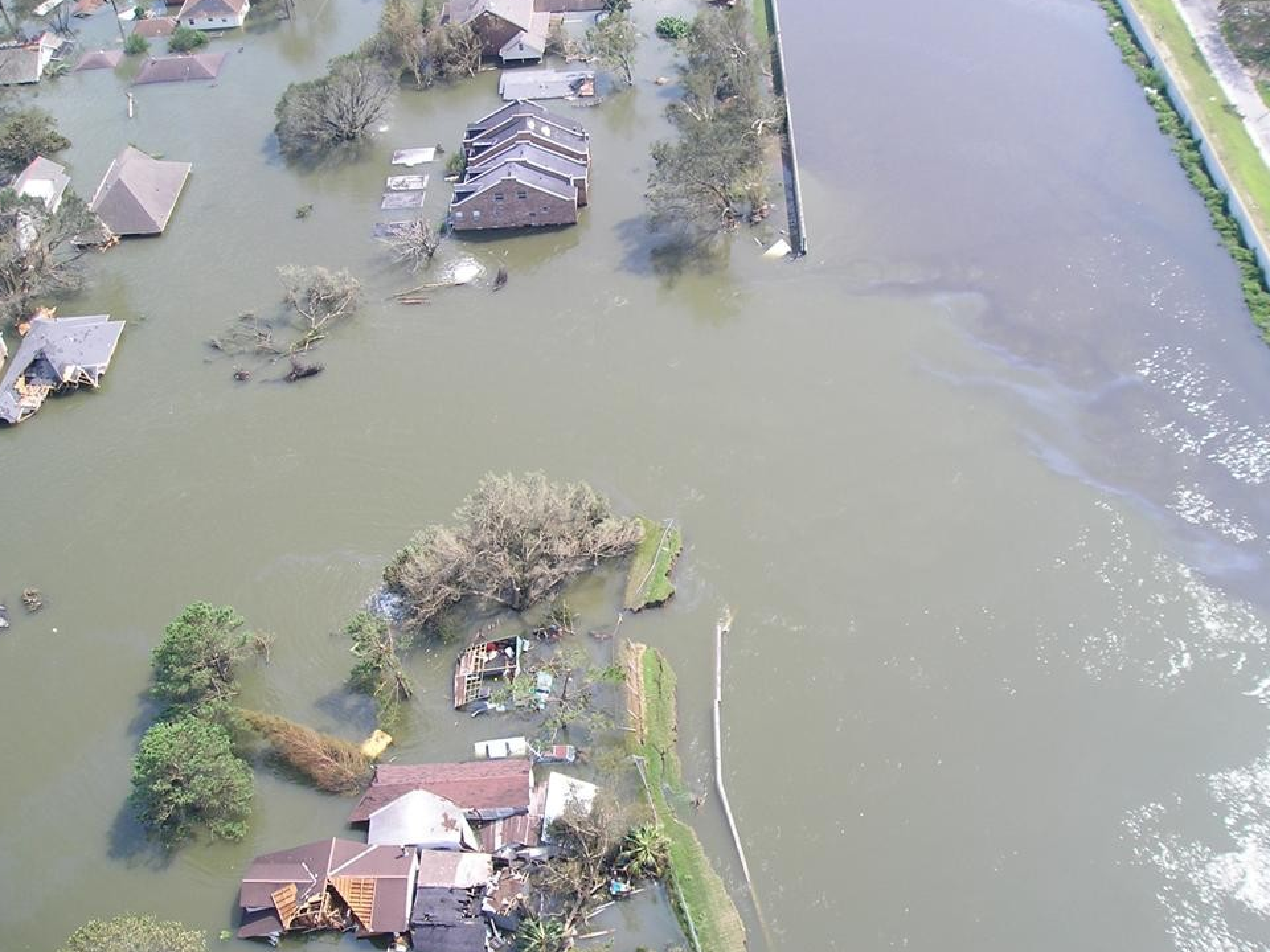
Basic Strategy

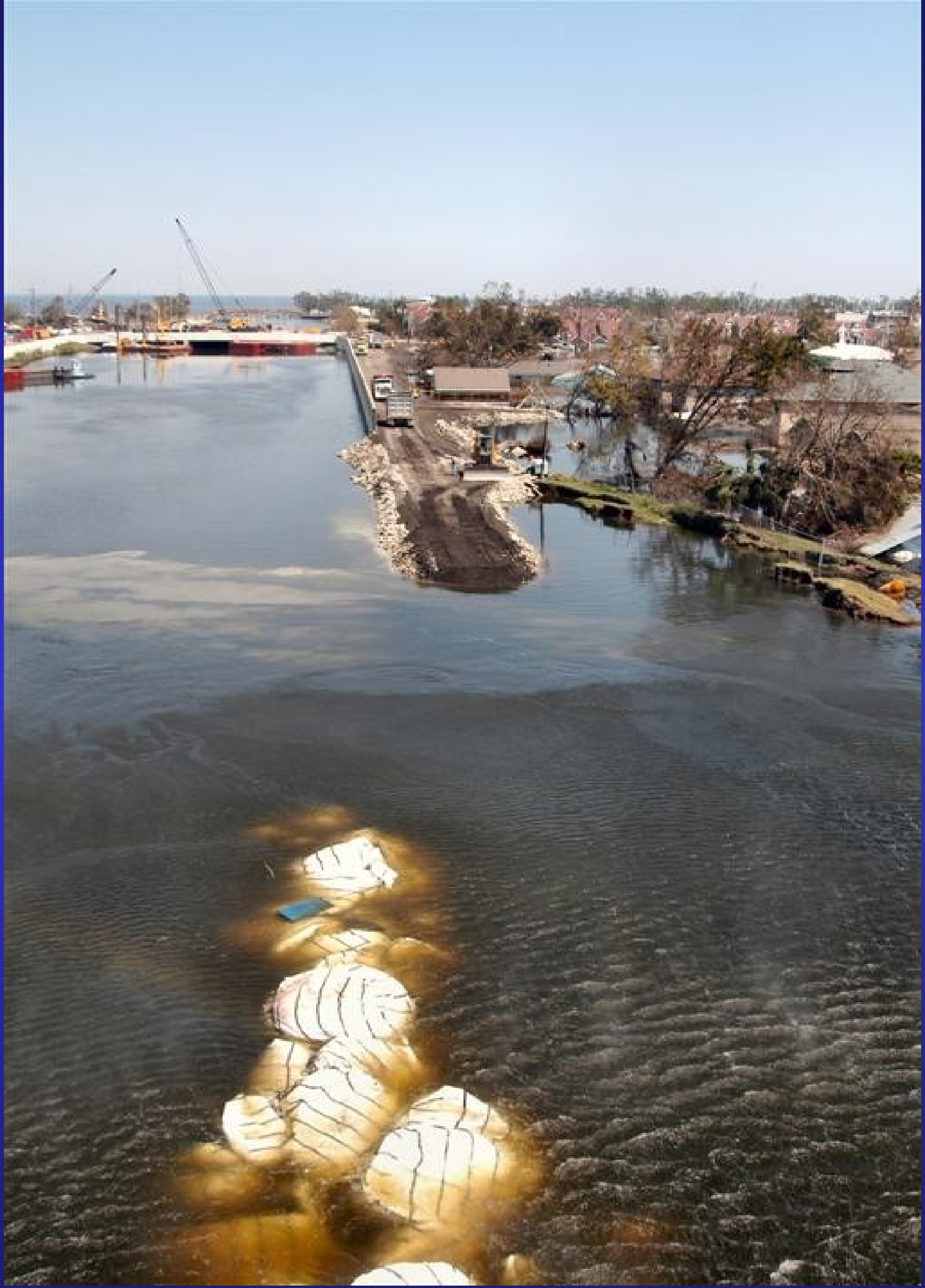
Basic Strategy

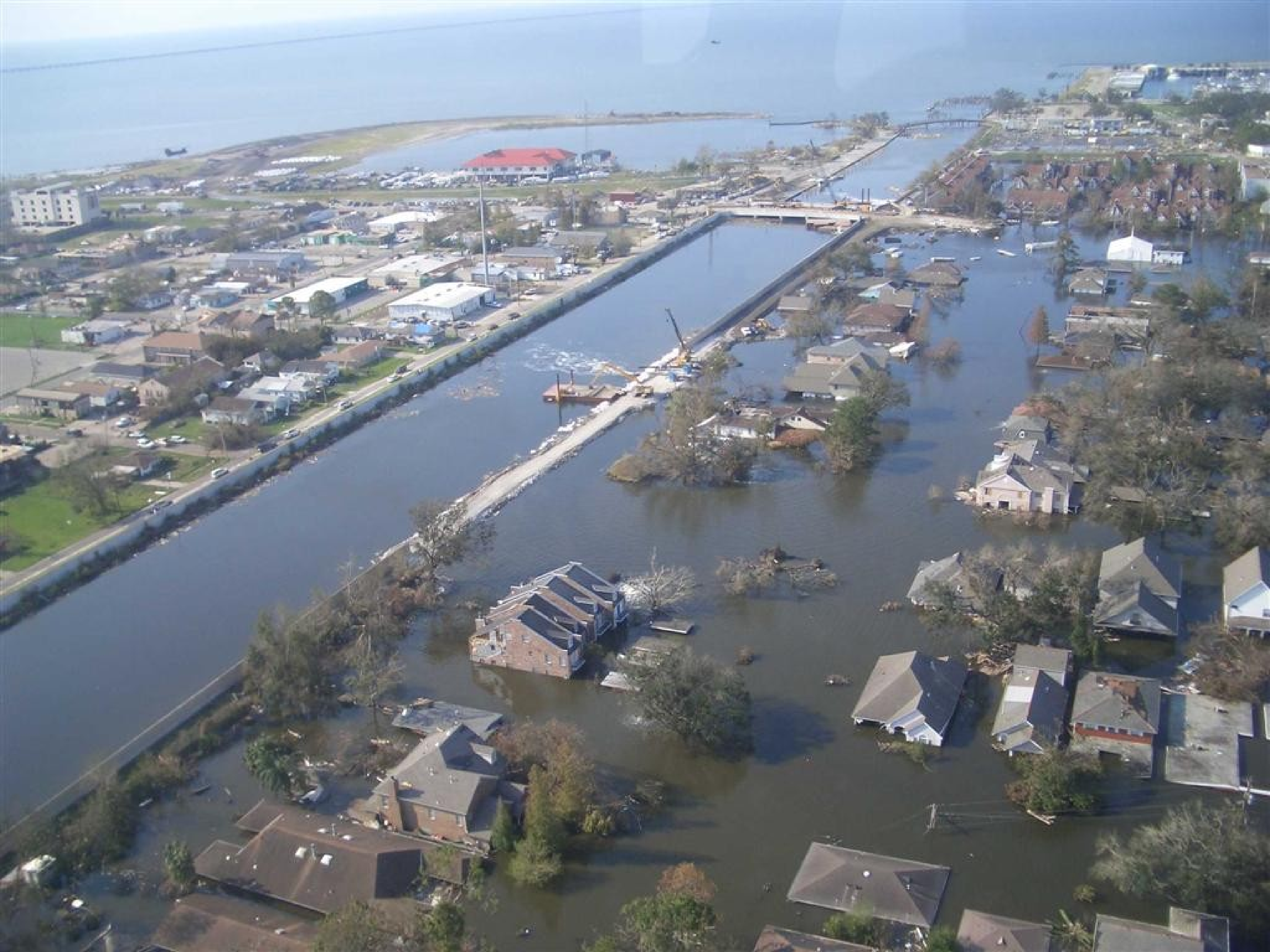
Basic Strategy

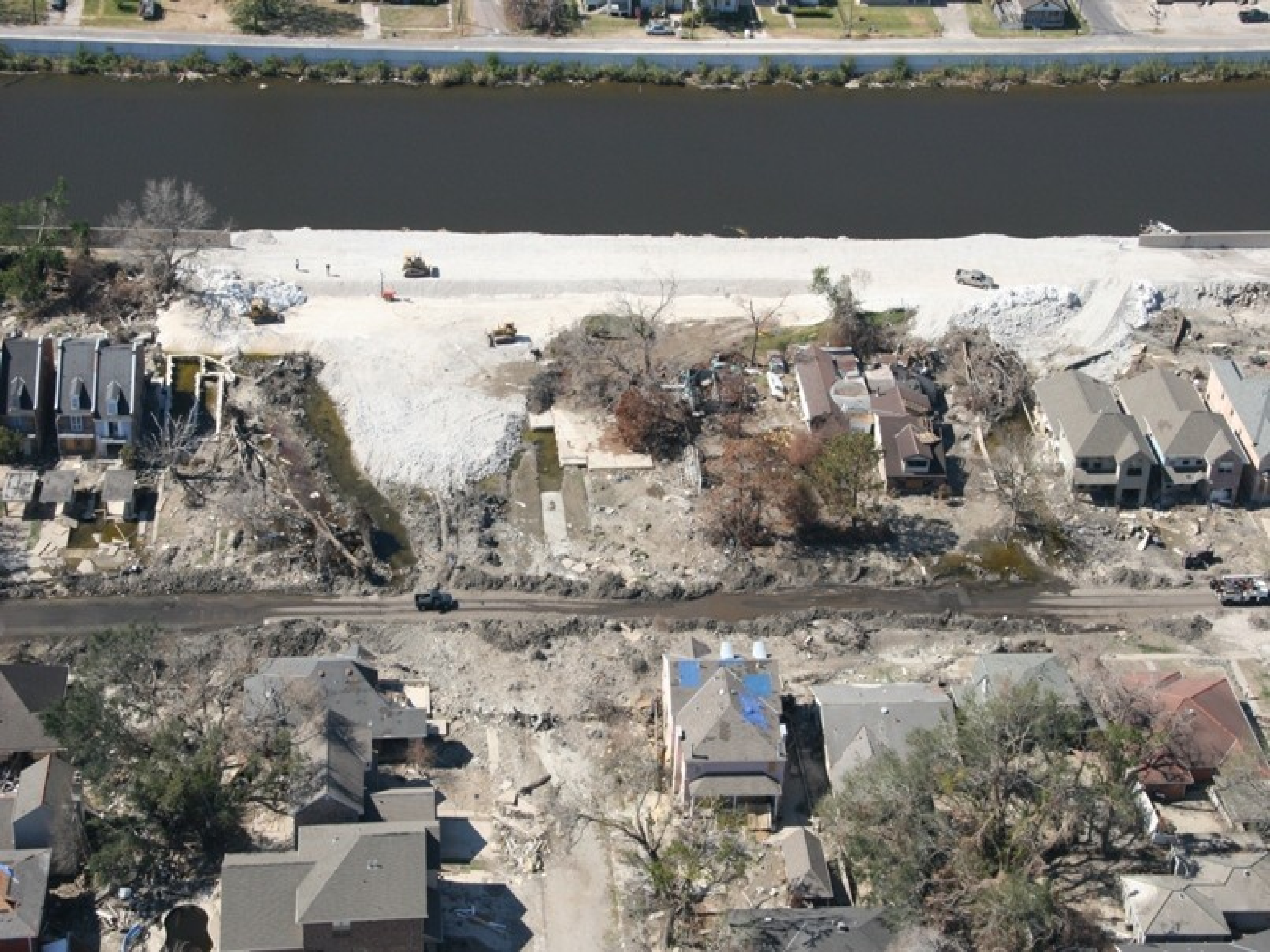
Basic Strategy

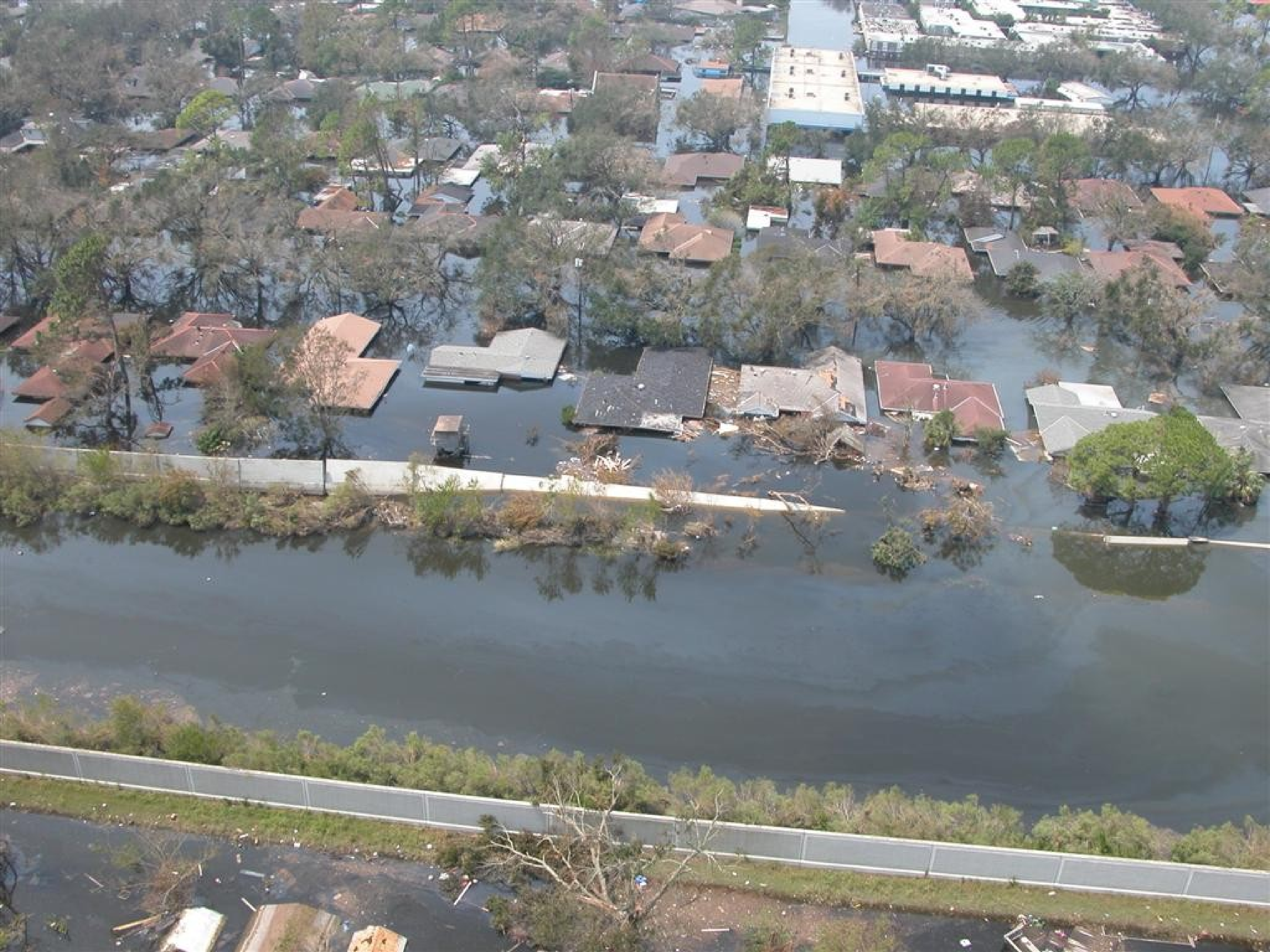
RESULTS

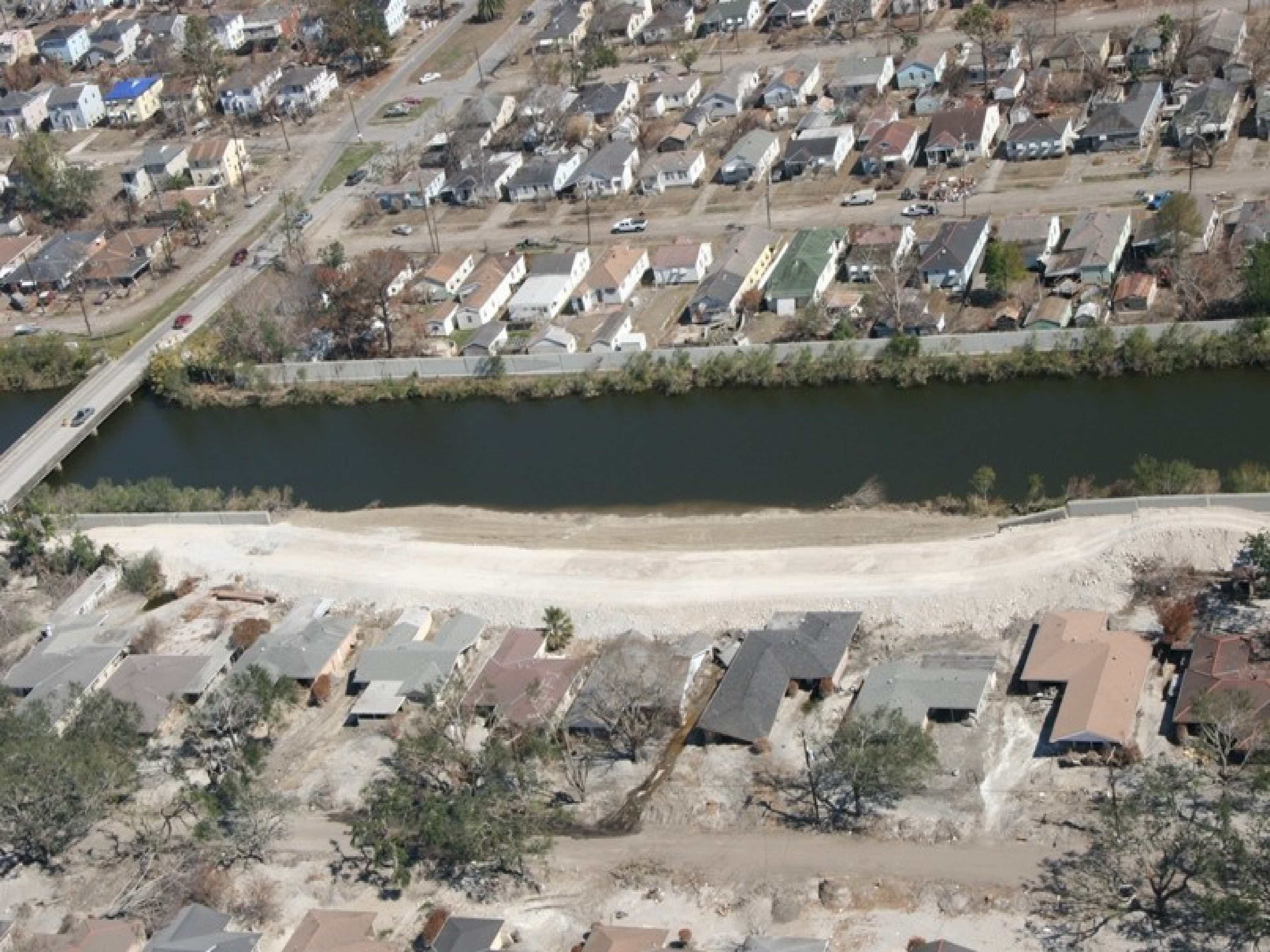


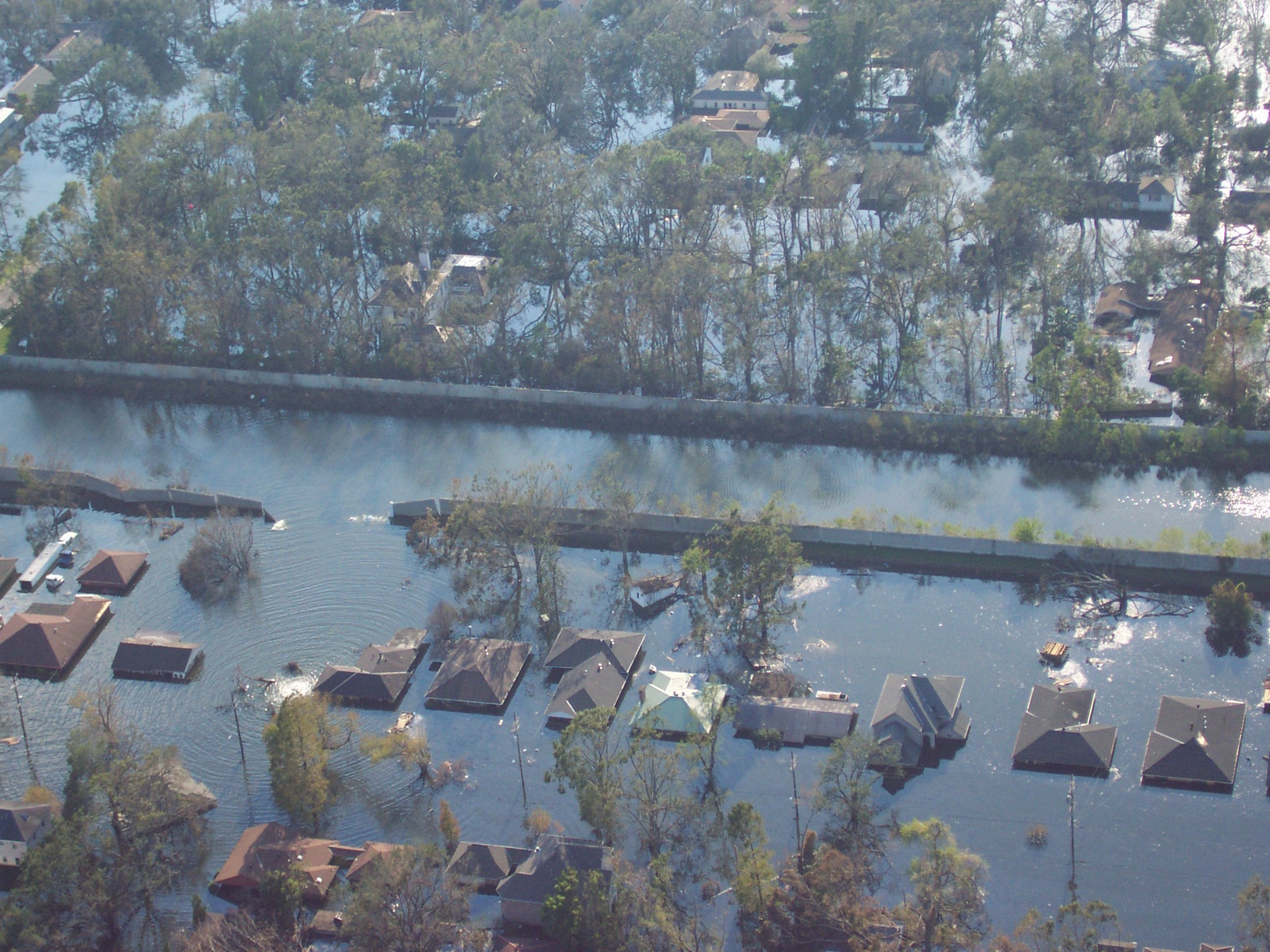


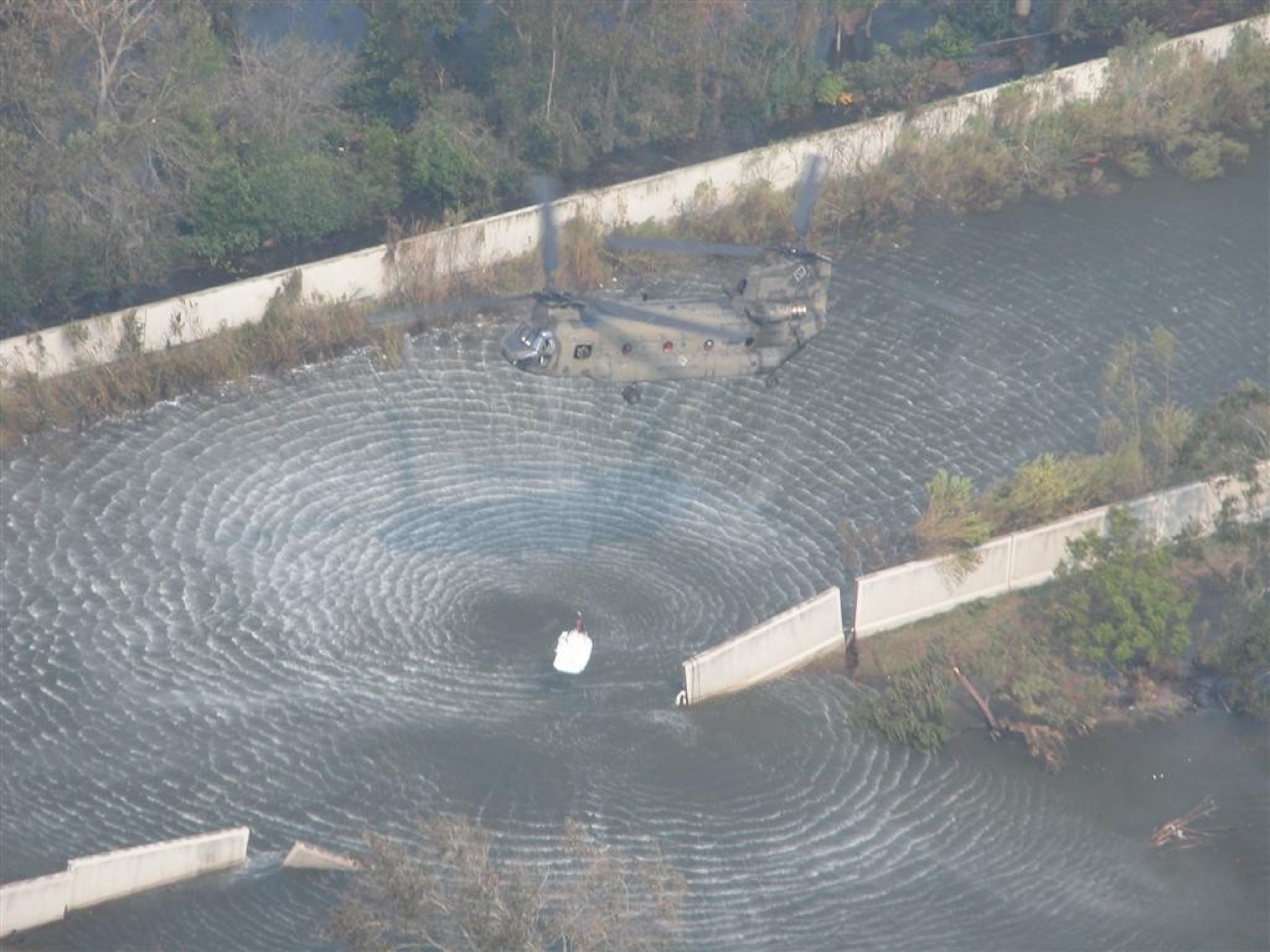


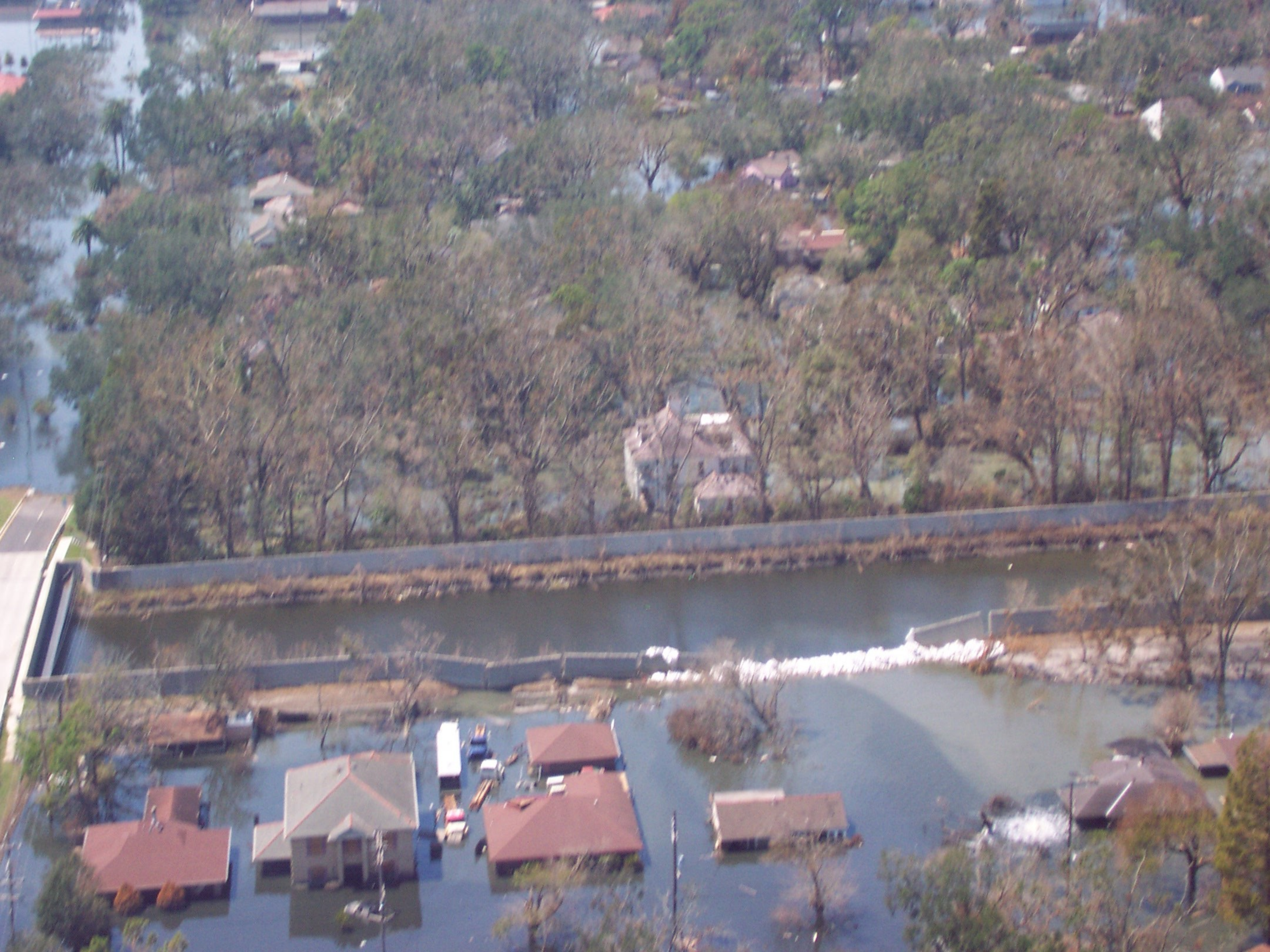


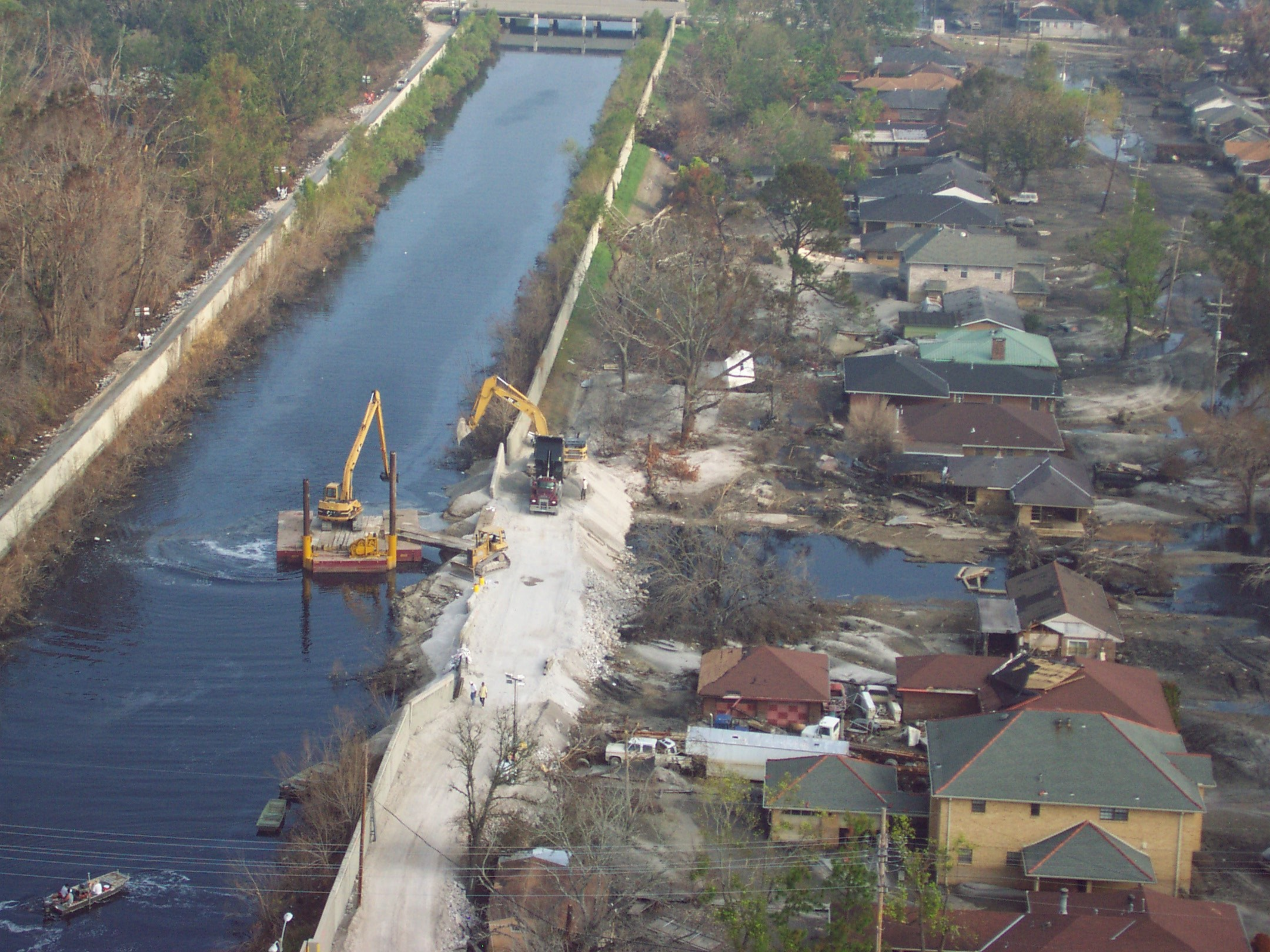


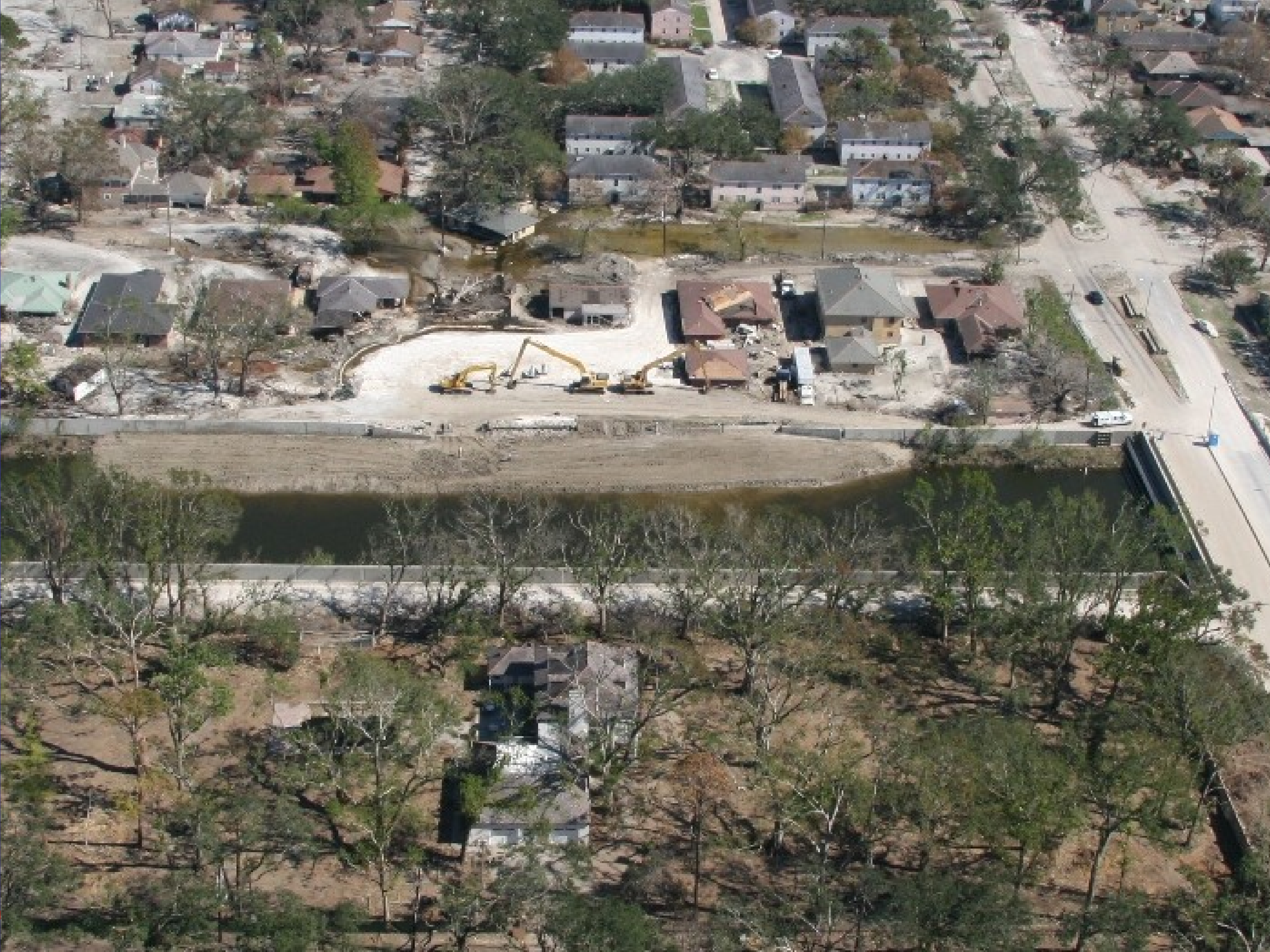


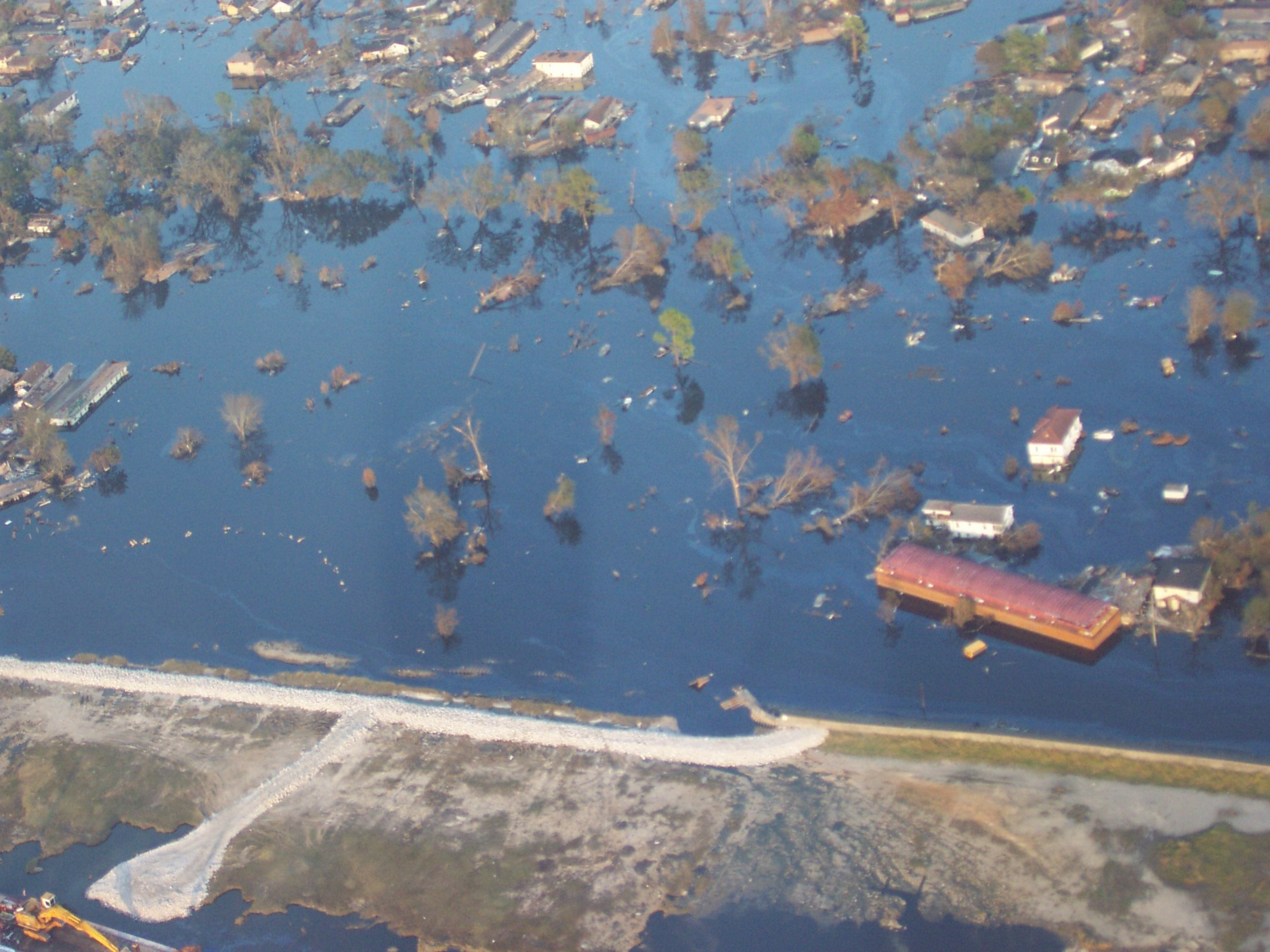


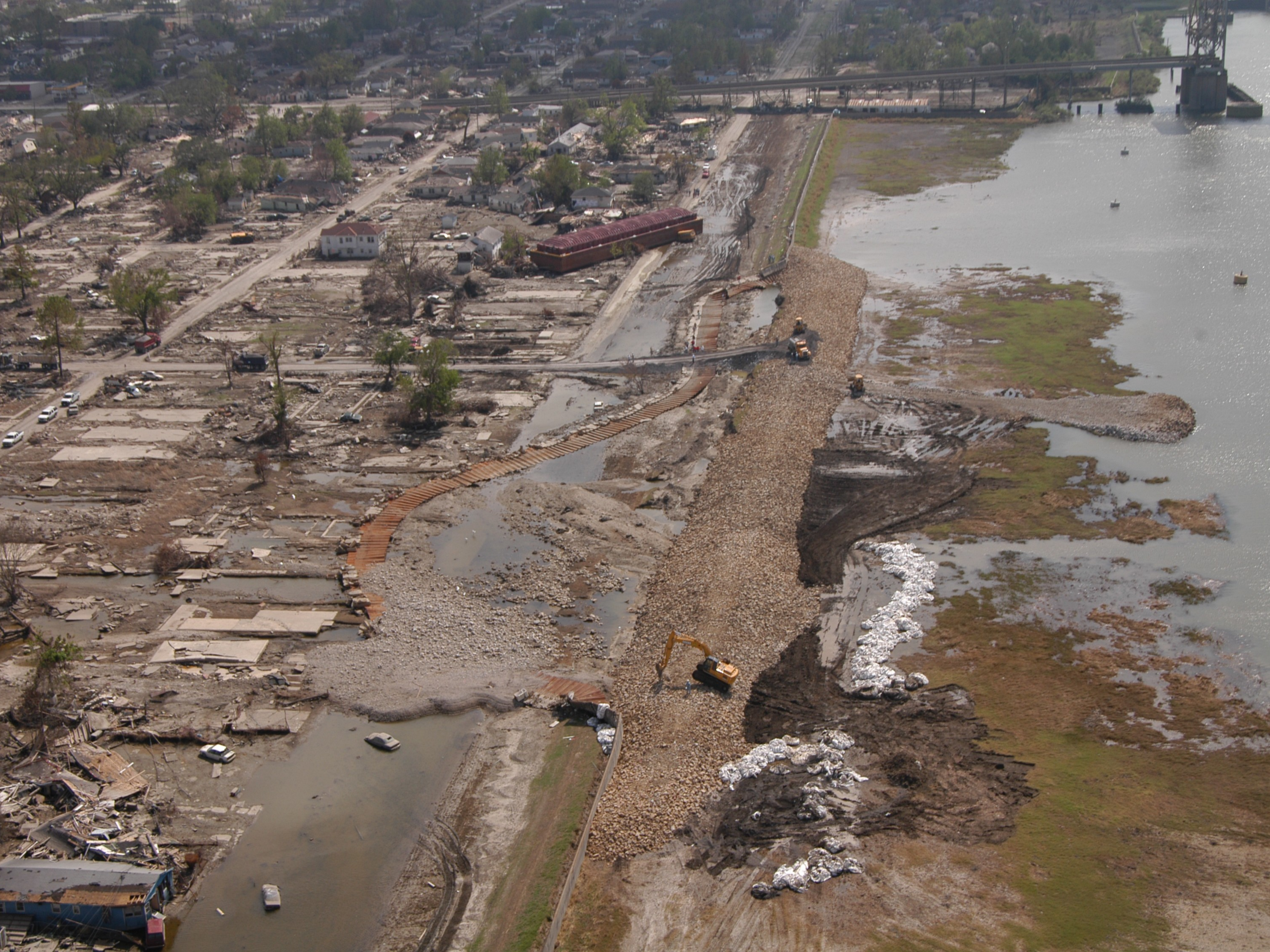


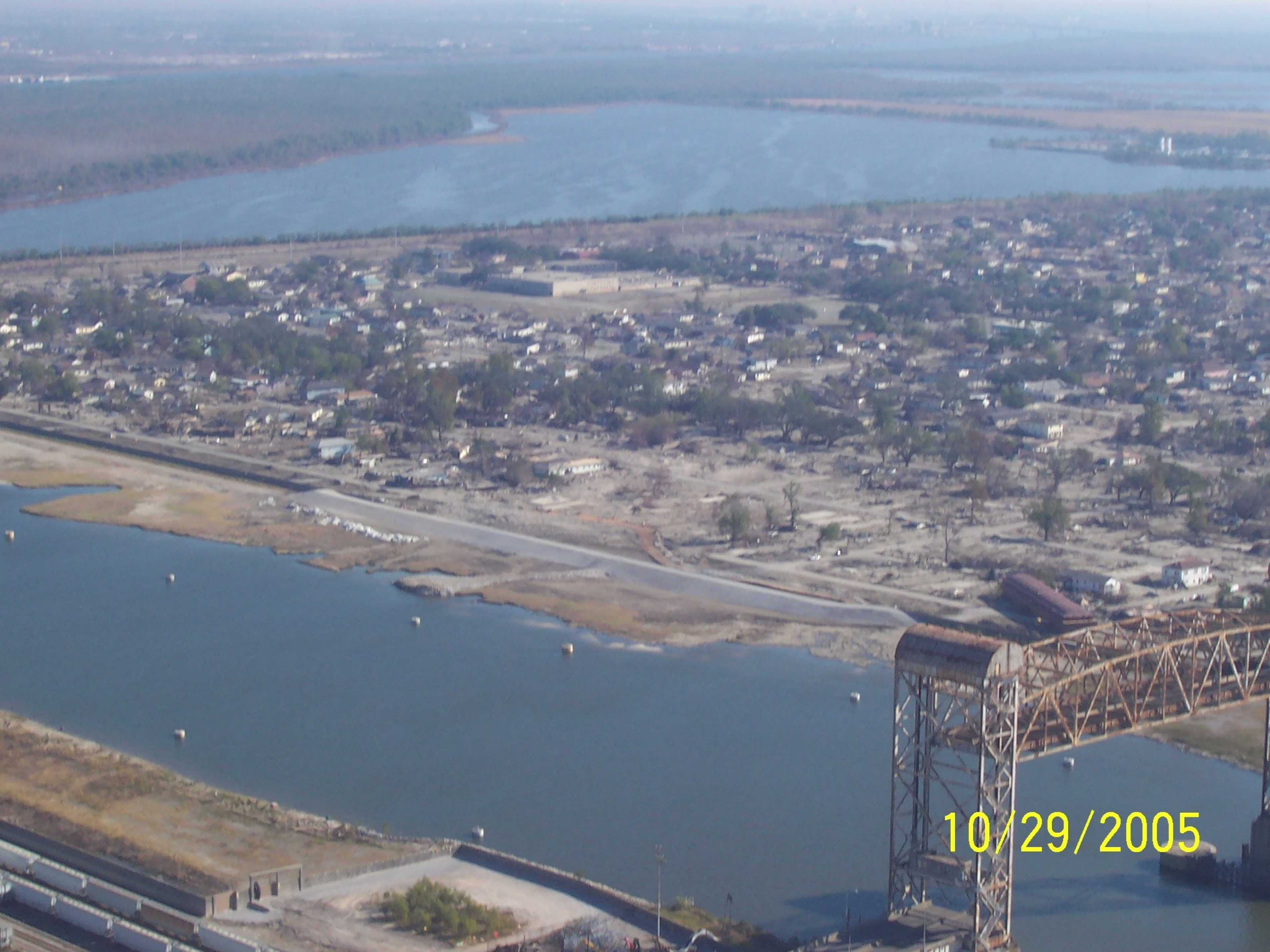











10/29/2005

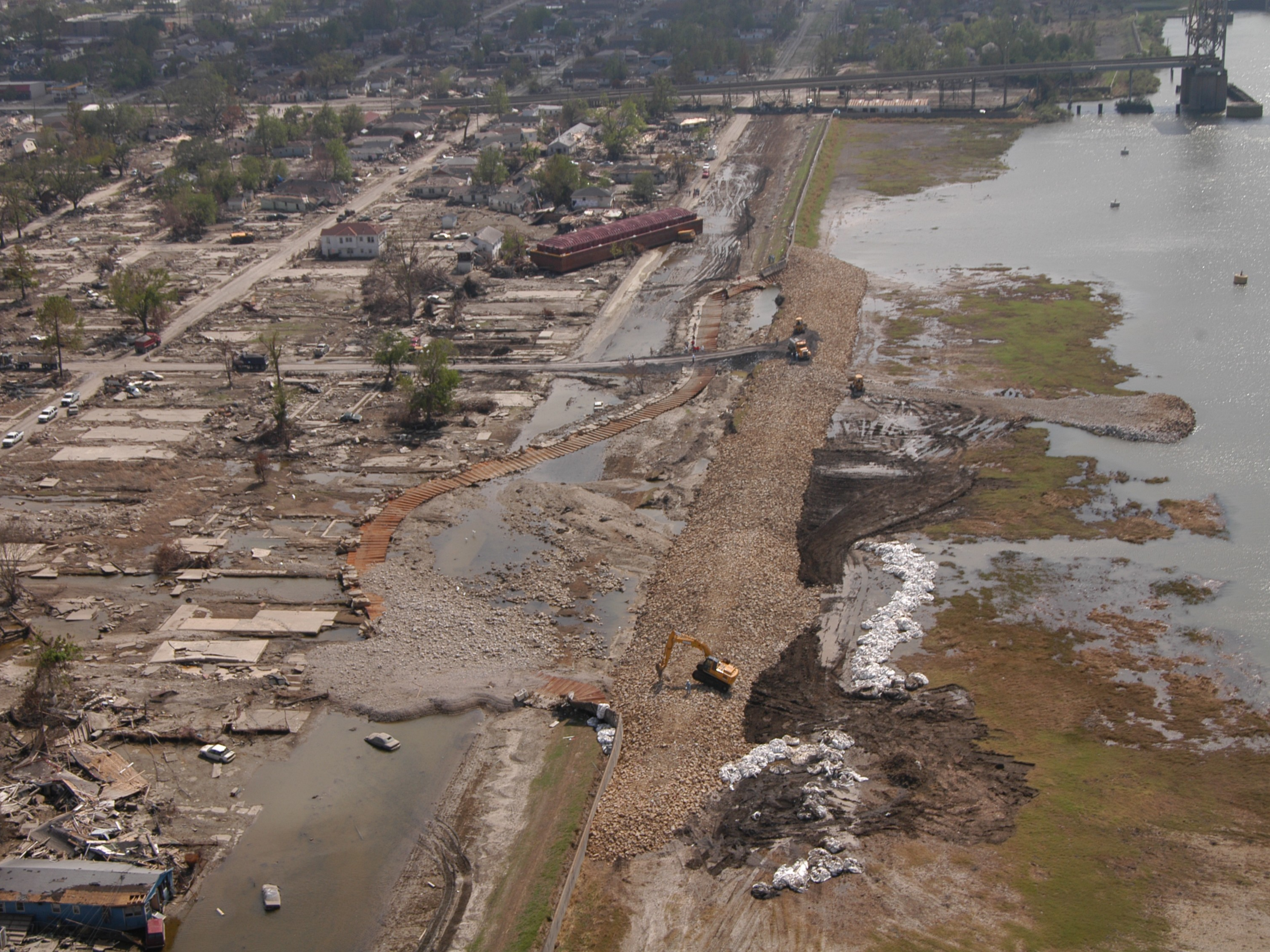
TURBO
MAGNUM
CAUTION
Country Joe

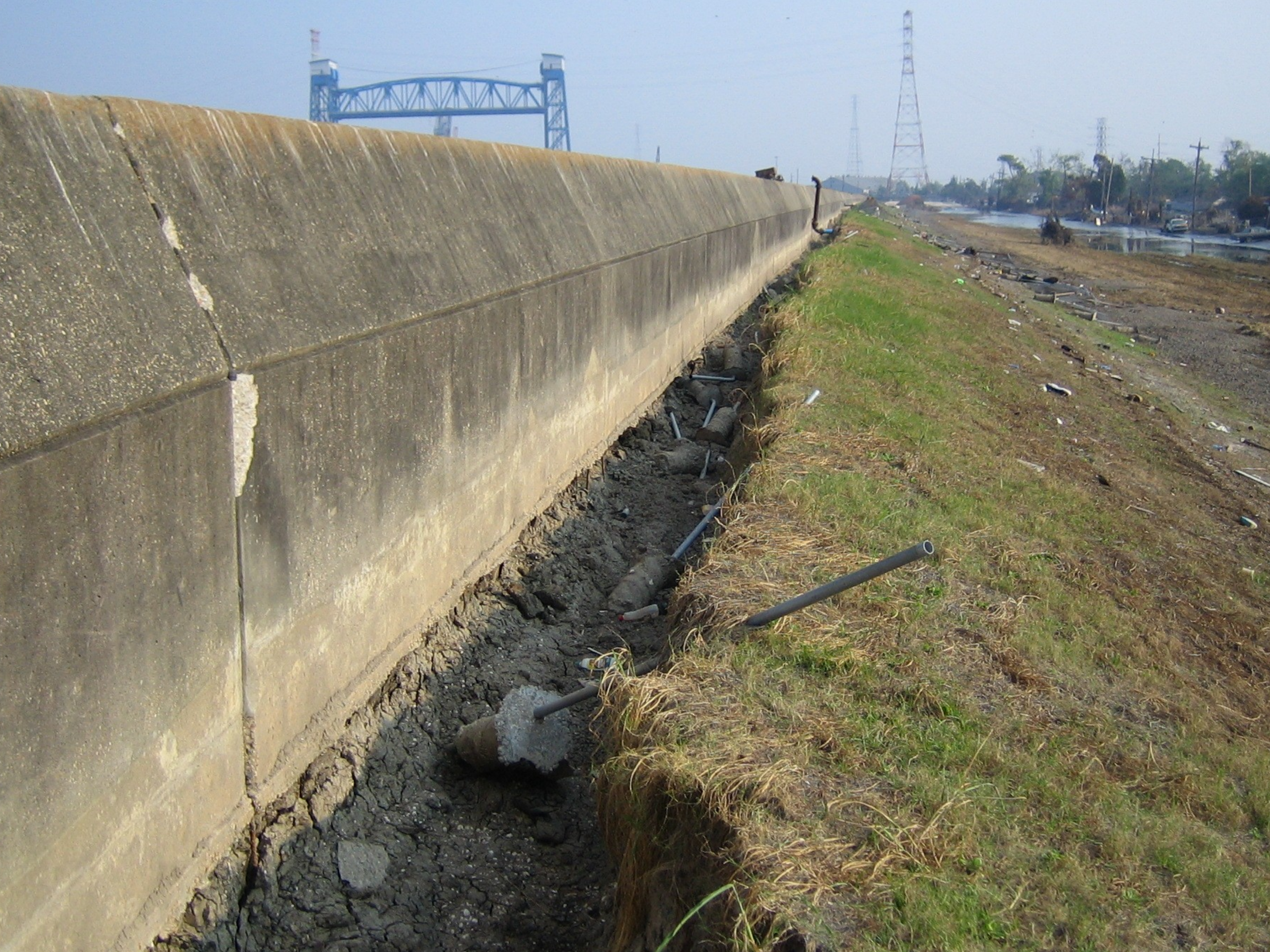
Drained 250+ Billion Gallons of Water

Repaired Nine Major Breaches

Provided Near Term Protection

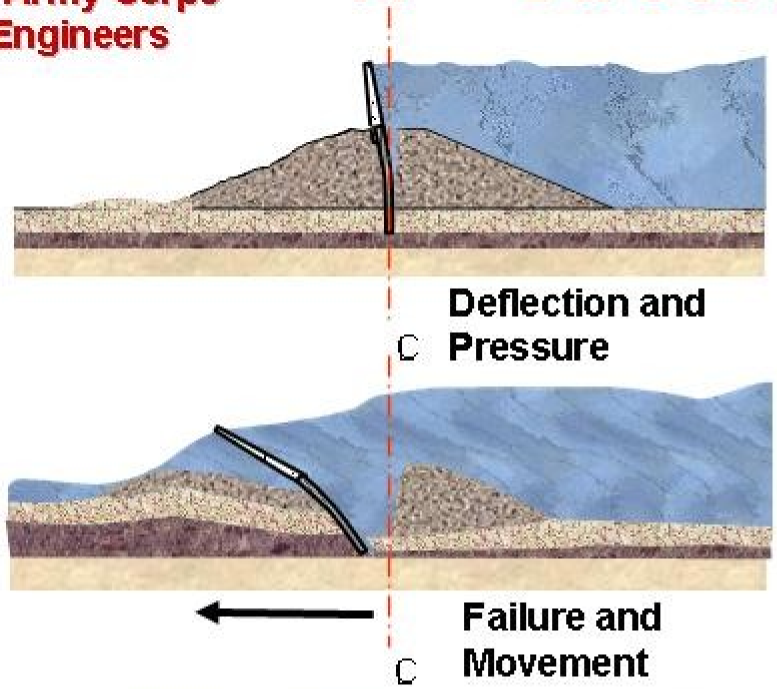
Floodwall
Failure Mechanisms





US Army Corps of Engineers

17th Street Breach Mechanism

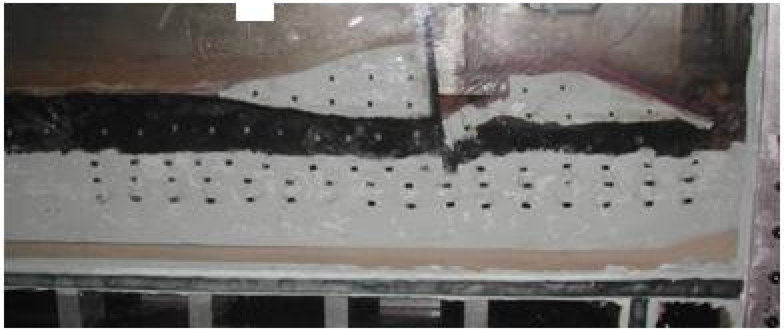


Deflection and Pressure

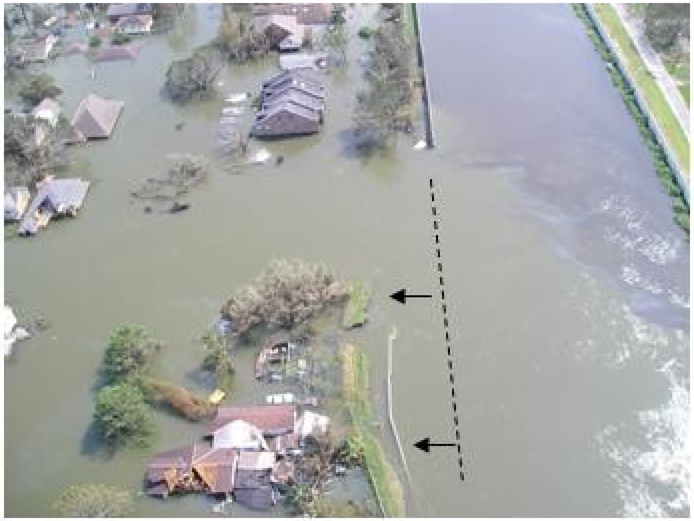
Failure and Movement

17th Street Canal Breach

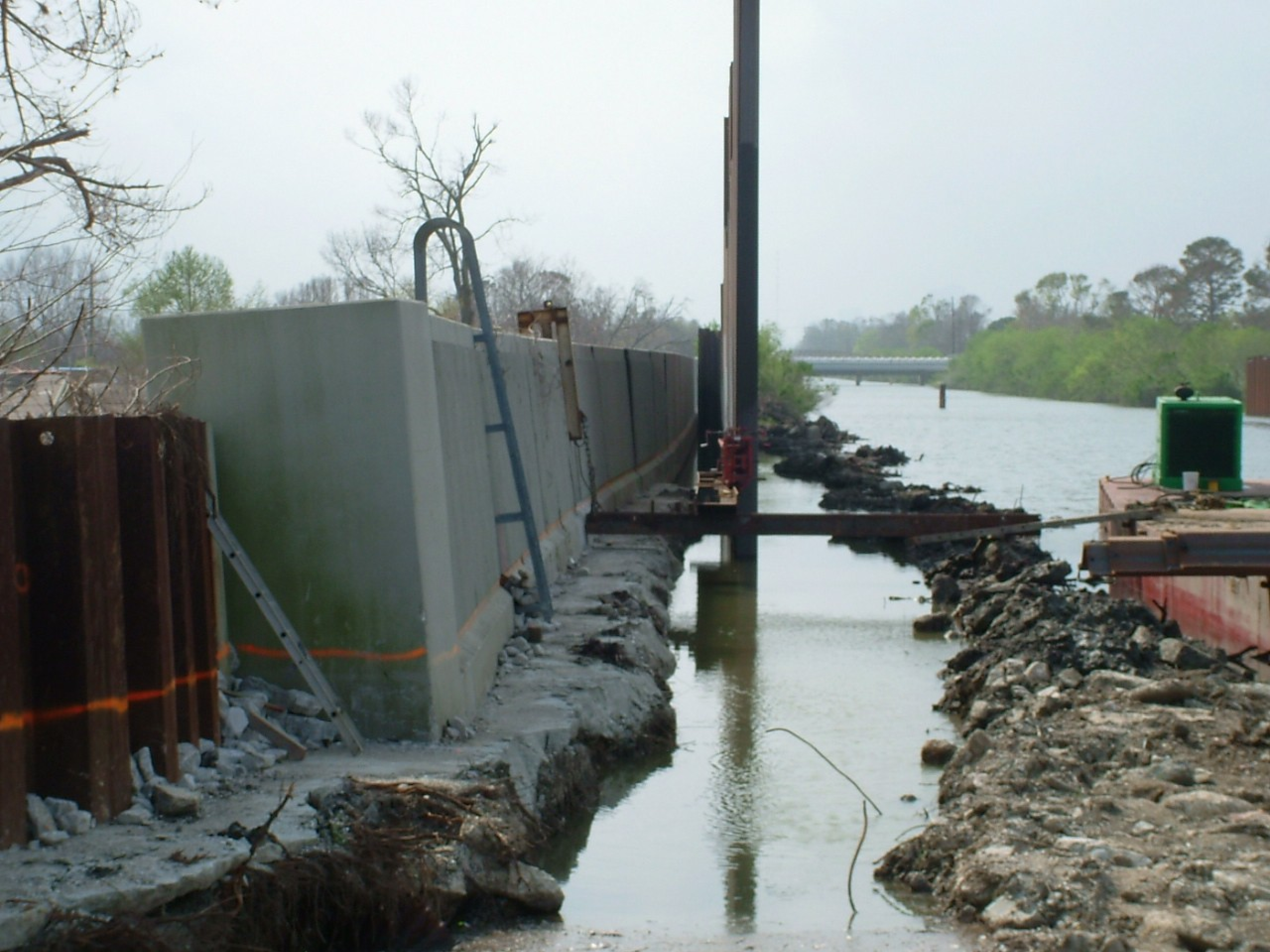
- Deflection of I–Wall by surge/waves
- Full hydrostatic pressure along wall
- Weak clay at levee toe causes failure in subsurface clay layer
- Soil block from wall back displaced



Confirmation in Centrifuge



Displacement of wall and part of levee



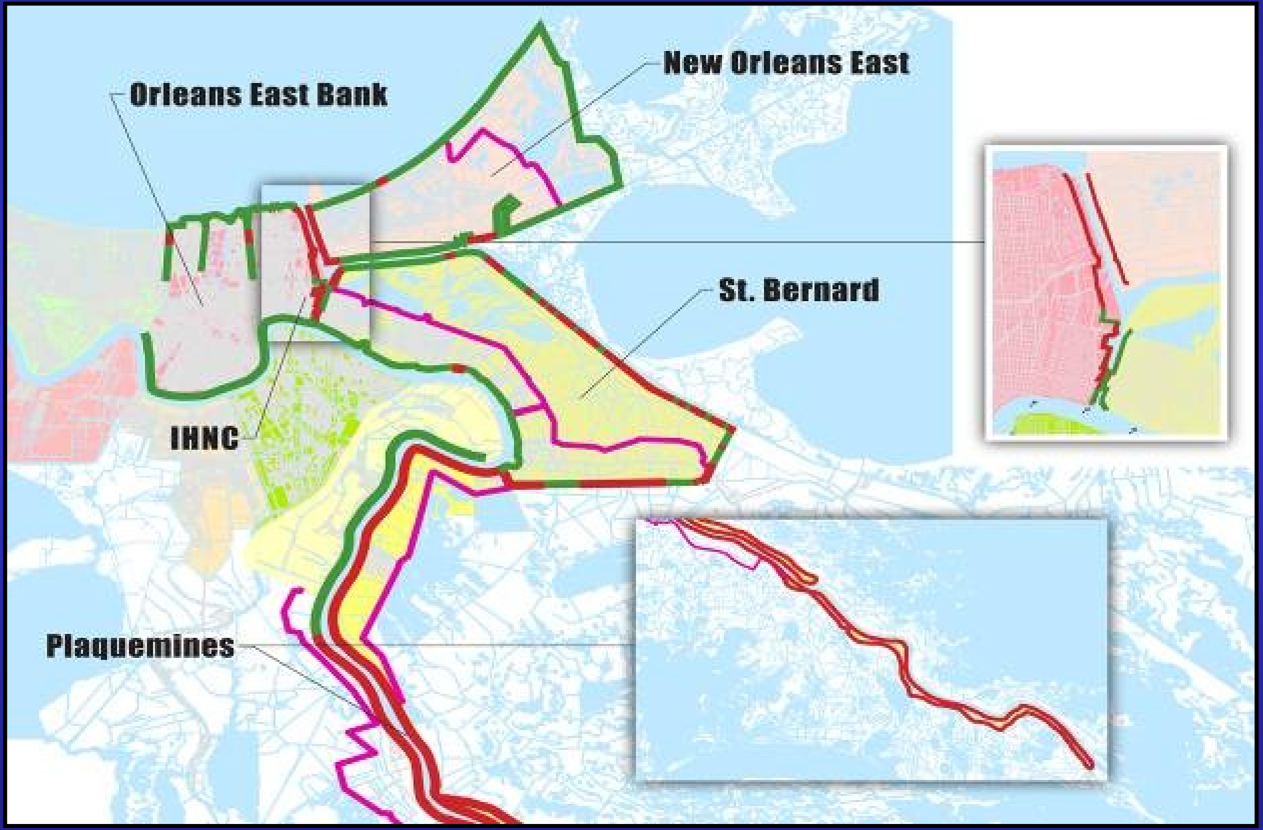
Task Force Guardian

www.mvn.usace.army.mil

Task Force Guardian

- Restore Hurricane Protection System to pre-Hurricane Katrina levels of protection prior to 1 June 2006

Hurricane Protection System Restoration Program Summary


Orleans East Bank
New Orleans East
St. Bernard
IHNC
Plaquemines

Hurricane Protection System
- 284 miles: Federal levees / floodwalls
- 71 pump stations

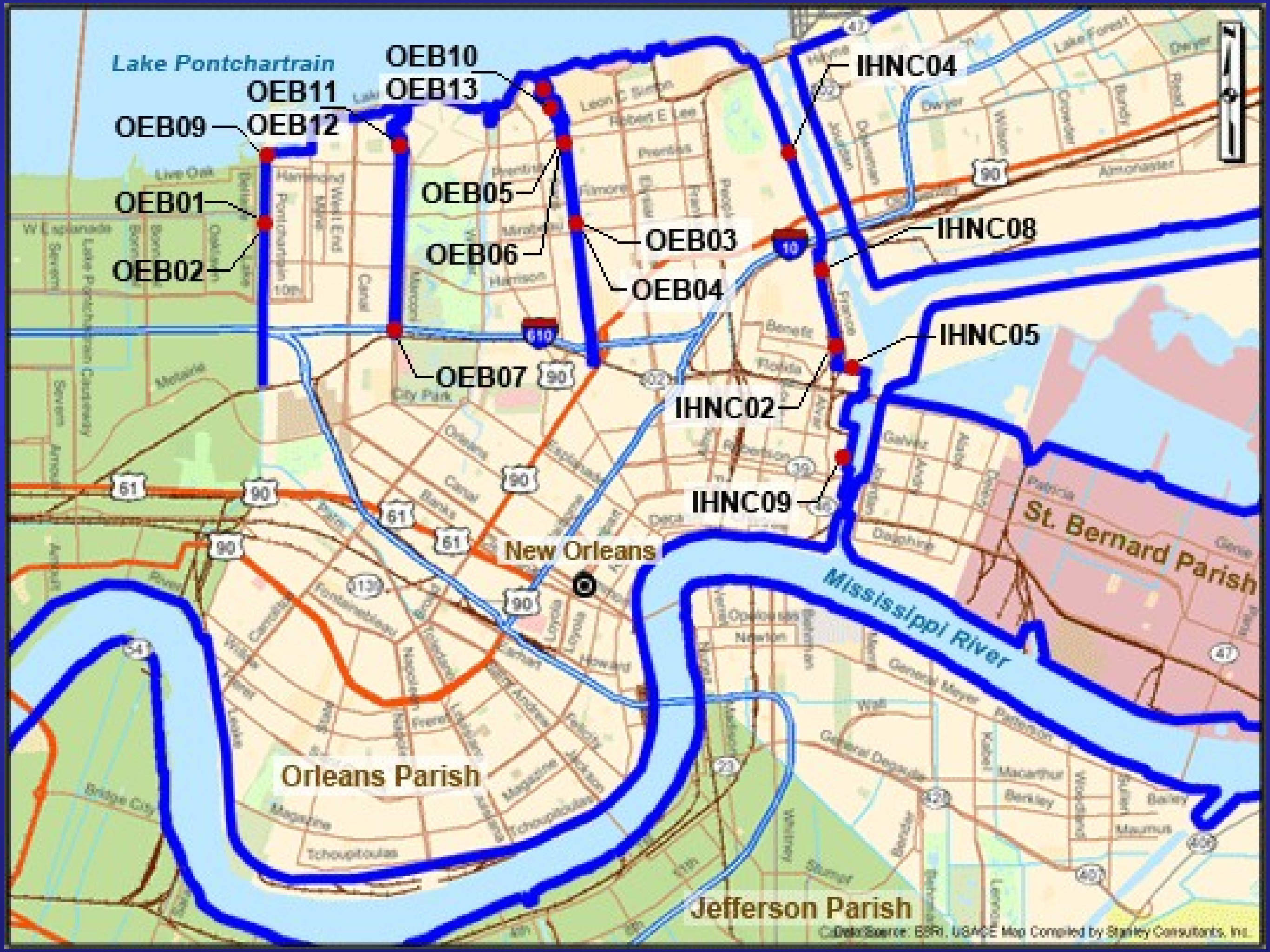
Damage
- 169 miles: Federal levees / floodwalls
- 34 pump stations

Cost
- $428M

US Army Corps
of Engineers ®

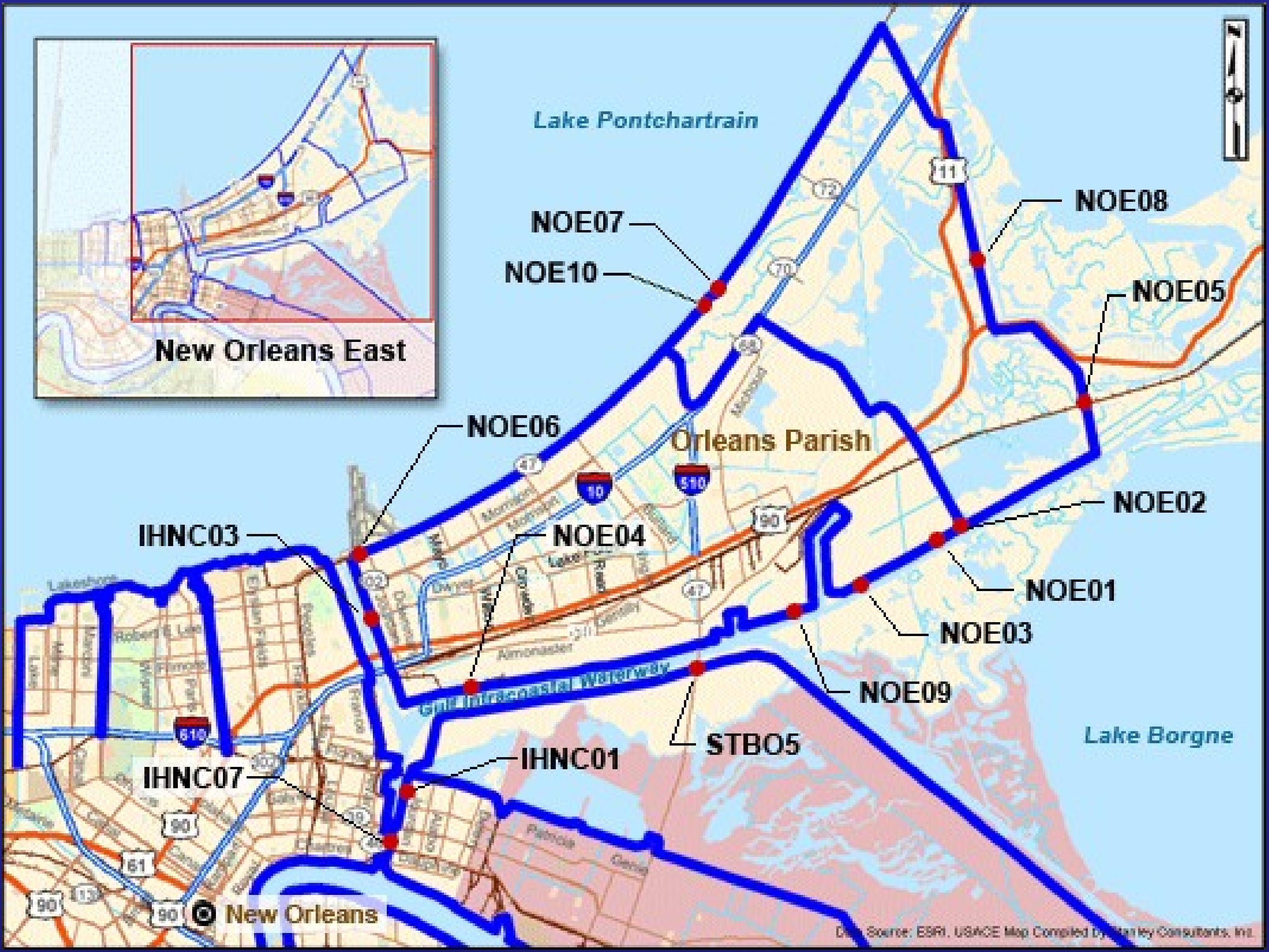
Orleans East Bank

14 projects – $105.6M


Lake Pontchartrain
OEB10
OEB13
OEB11
OEB12
OEB09
OEB01
OEB02
OEB05
OEB06
OEB03
OEB04
OEB07
IHNC04
IHNC08
IHNC05
IHNC02
IHNC09
New Orleans
Mississippi River
St. Bernard Parish
Orleans Parish
Jefferson Parish
Data Source: ESRI, USACE Map Compiled by Stanley Consultants, Inc.

New Orleans East

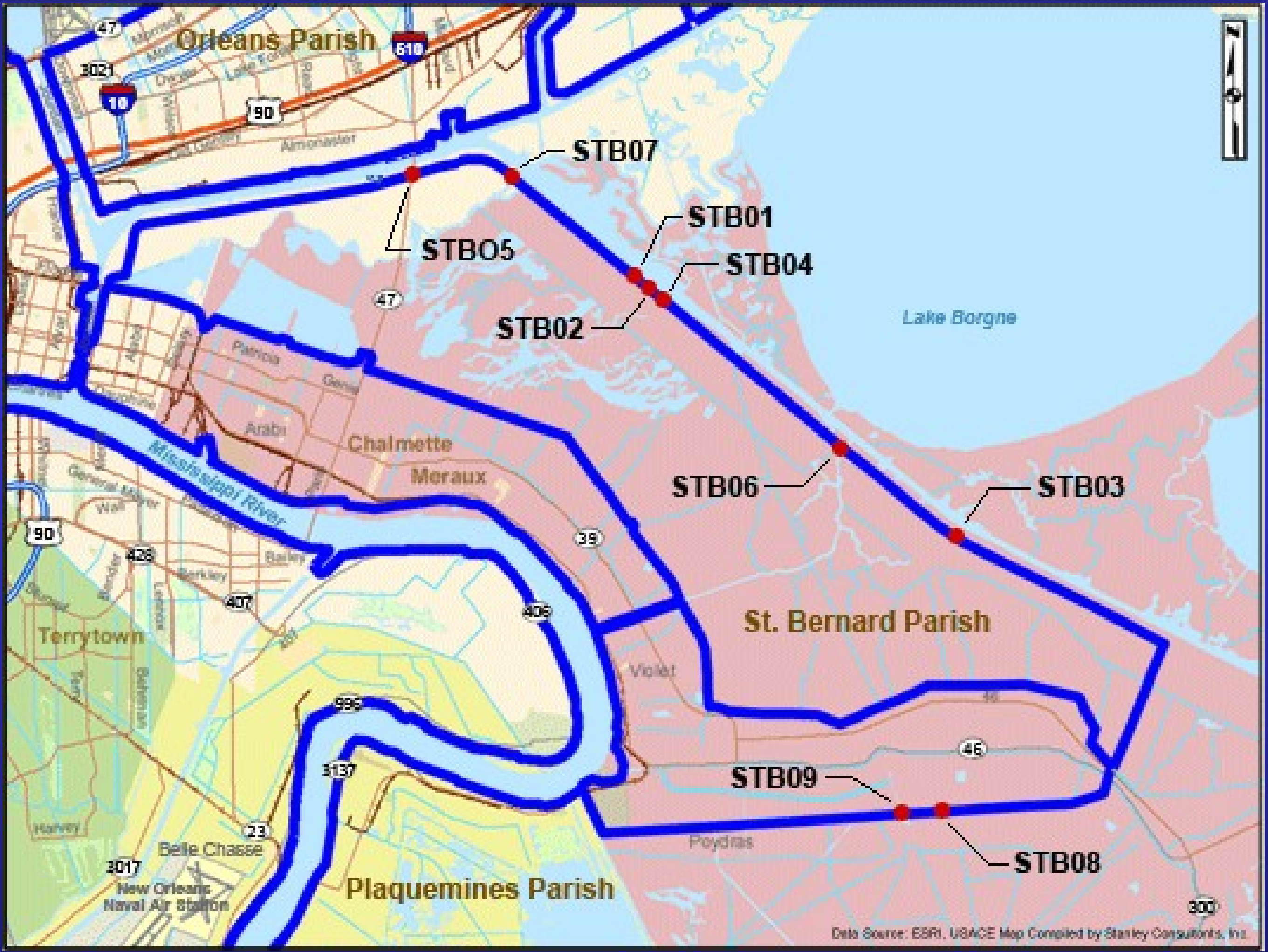
13 projects – $89.4M


New Orleans East
Lake Pontchartrain
NOE07
NOE10
NOE08
NOE05
NOE06
Orleans Parish
NOE02
IHNC03
NOE04
NOE01
NOE03
NOE09
Gulf Intracoastal Waterway
IHNC01
STBO5
Lake Borgne
IHNC07
New Orleans
11
72
70
47
10
510
90
610
61

Data Source: ESRI, USACE Map Compiled by Stanley Consultants, Inc.

Saint Bernard Parish

8 projects - $45.1M

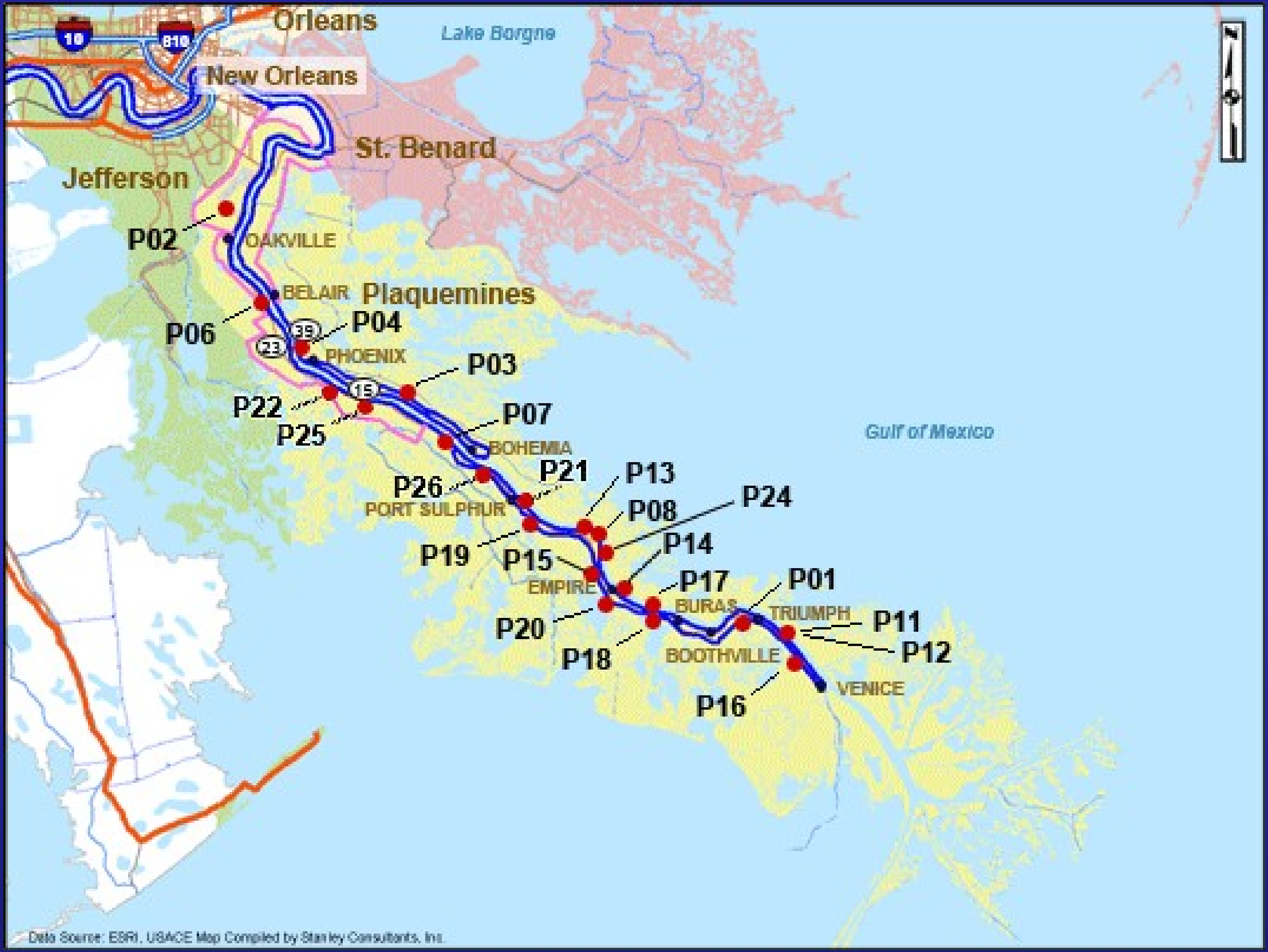

Orleans Parish
STB07
STB01
STBO5
STB04
STB02
Lake Borgne
Chalmette
Meraux
Arabi
Mississippi River
STB06
STB03
St. Bernard Parish
Terrytown
Violet
STB09
STB08
Poydras
Belle Chasse
New Orleans Naval Air Station
Plaquemines Parish
Data Source: ESRI, USACE Map Compiled by Stanley Consultants, Inc.

US Army Corps of Engineers ®

US Army Corps of Engineers

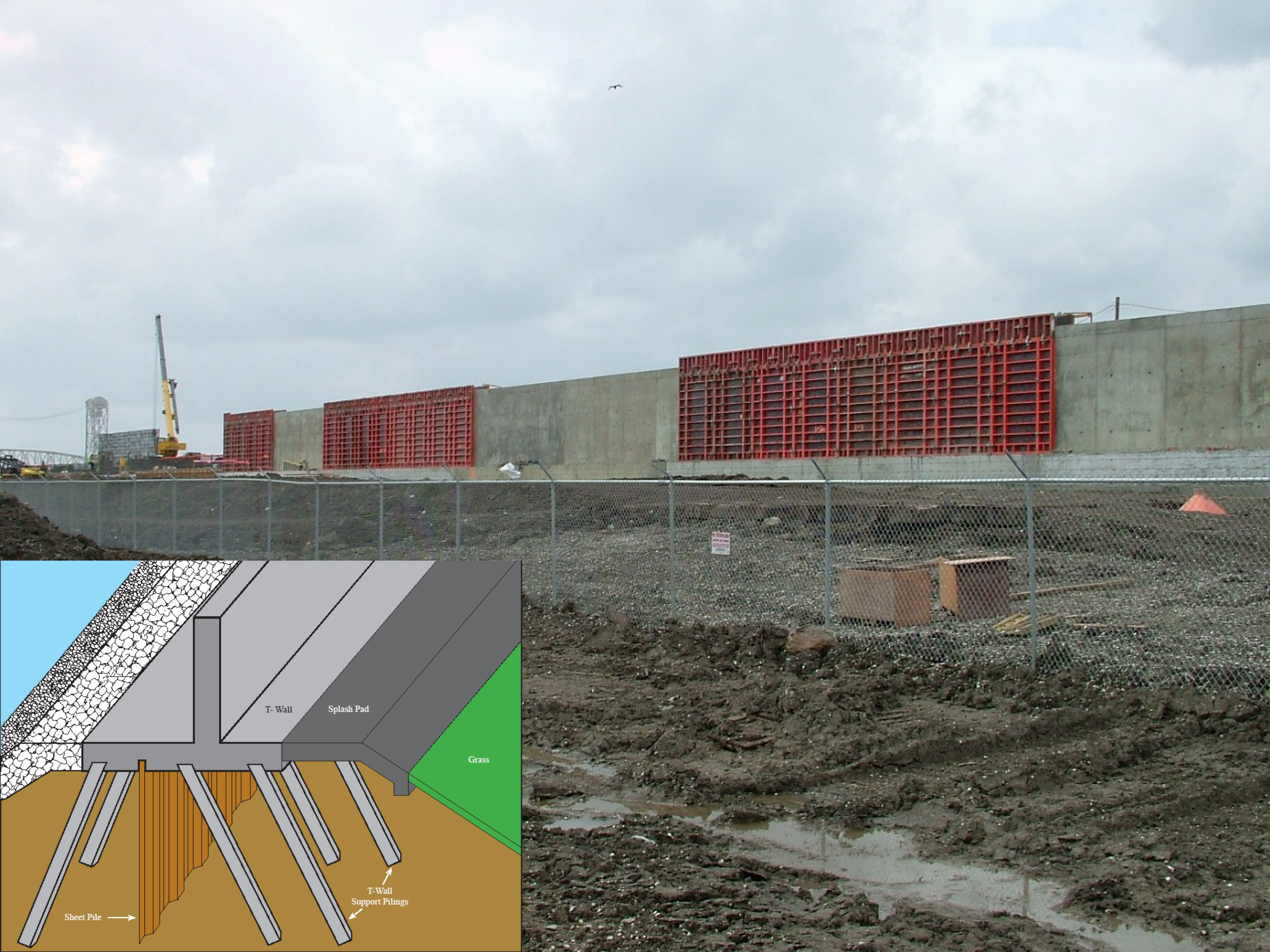
Plaquemines Pari

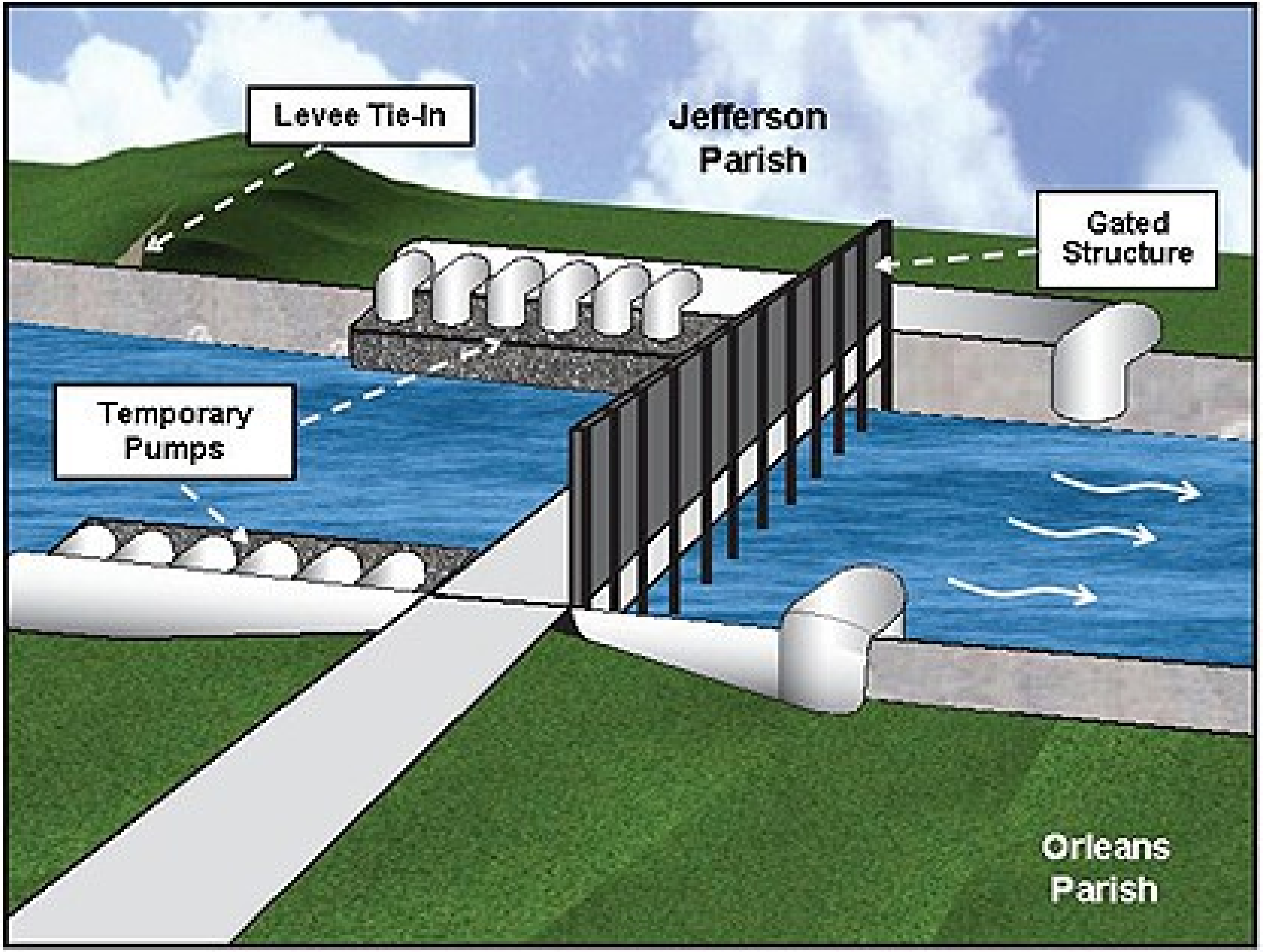
21 projects – $188M


10
810
Orleans
Lake Borgne
New Orleans
St. Benard
Jefferson
P02
OAKVILLE
BELAIR
Plaquemines
P06
39
P04
23
PHOENIX
P03
P22
15
P25
P07
BOHEMIA
Gulf of Mexico
P26
P21
P13
PORT SULPHUR
P08
P24
P19
P15
P14
EMPIRE
P17
P01
BURAS
TRIUMPH
P11
P20
P12
P18
BOOTHVILLE
VENICE
P16

Data Source: ESRI, USACE Map Compiled by Stanley Consultants, Inc.

One Team: Relevant, Ready, Responsive, Reliable

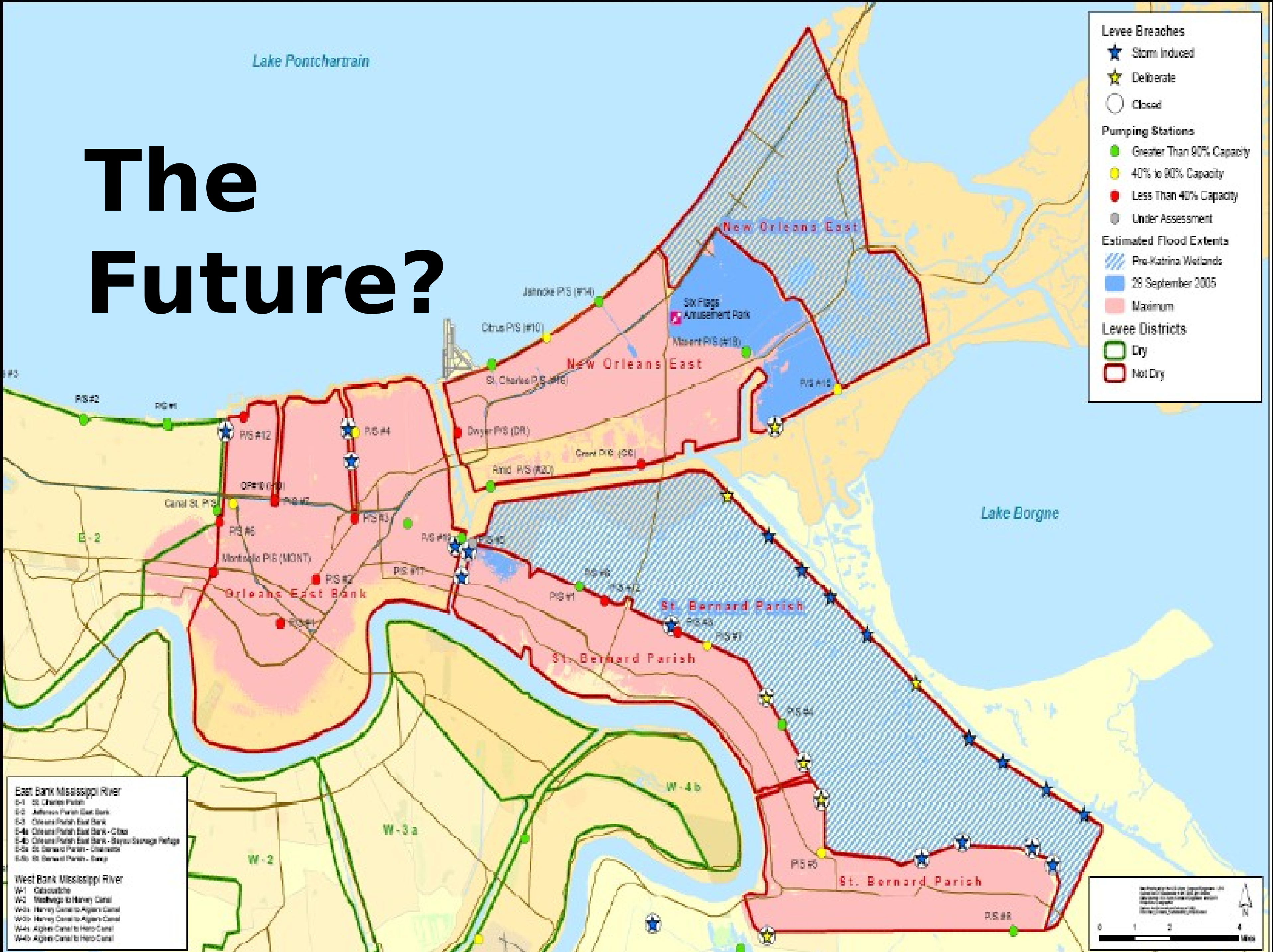

T- Wall
Splash Pad
Grass
T-Wall
Support Pilings
Sheet Pile


Levee Tie-In
Jefferson Parish
Gated Structure
Temporary Pumps
Orleans Parish

322B
SULLAIR

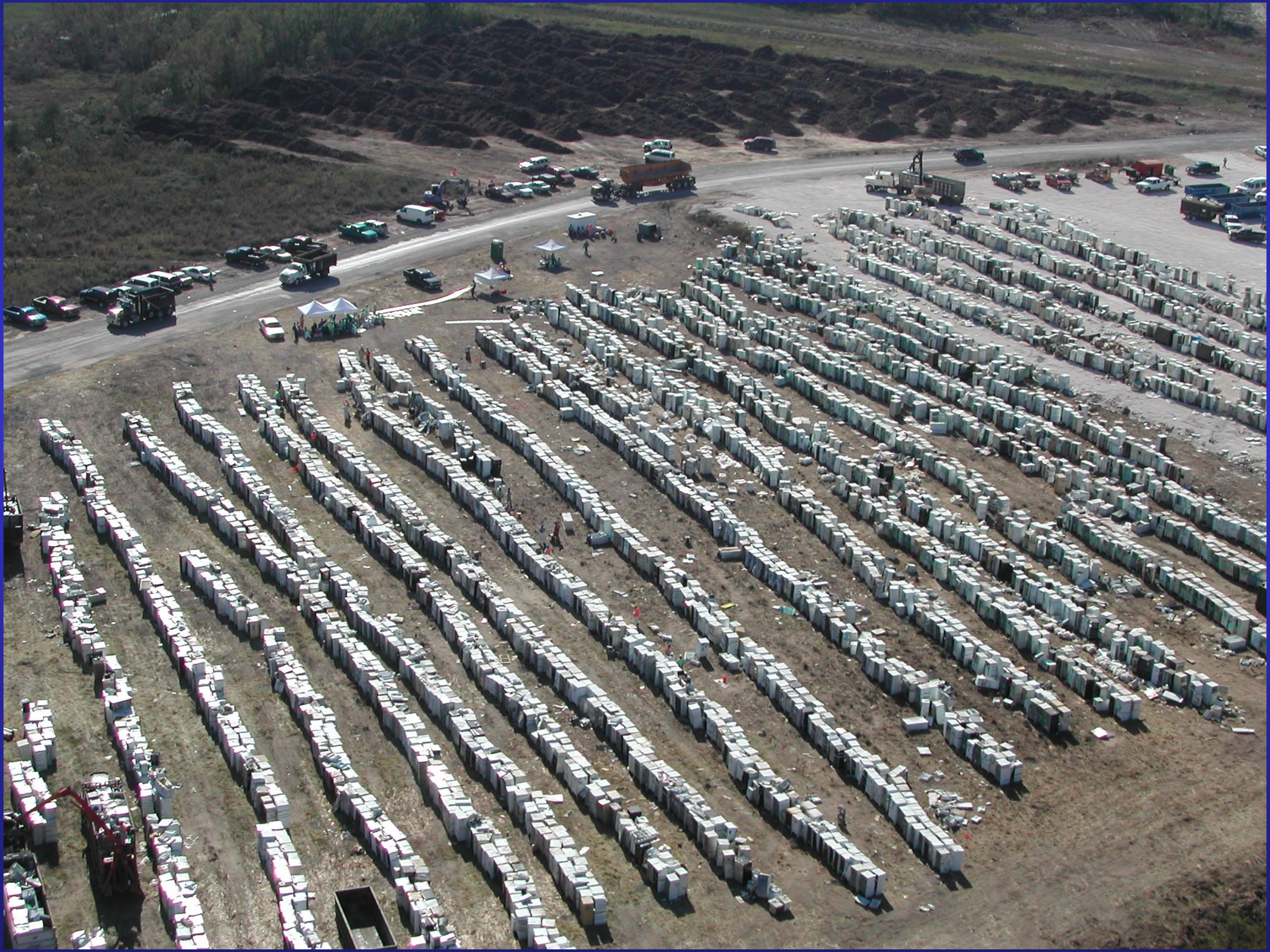
KOMATSU
KOMATSU
MACK

The Future?

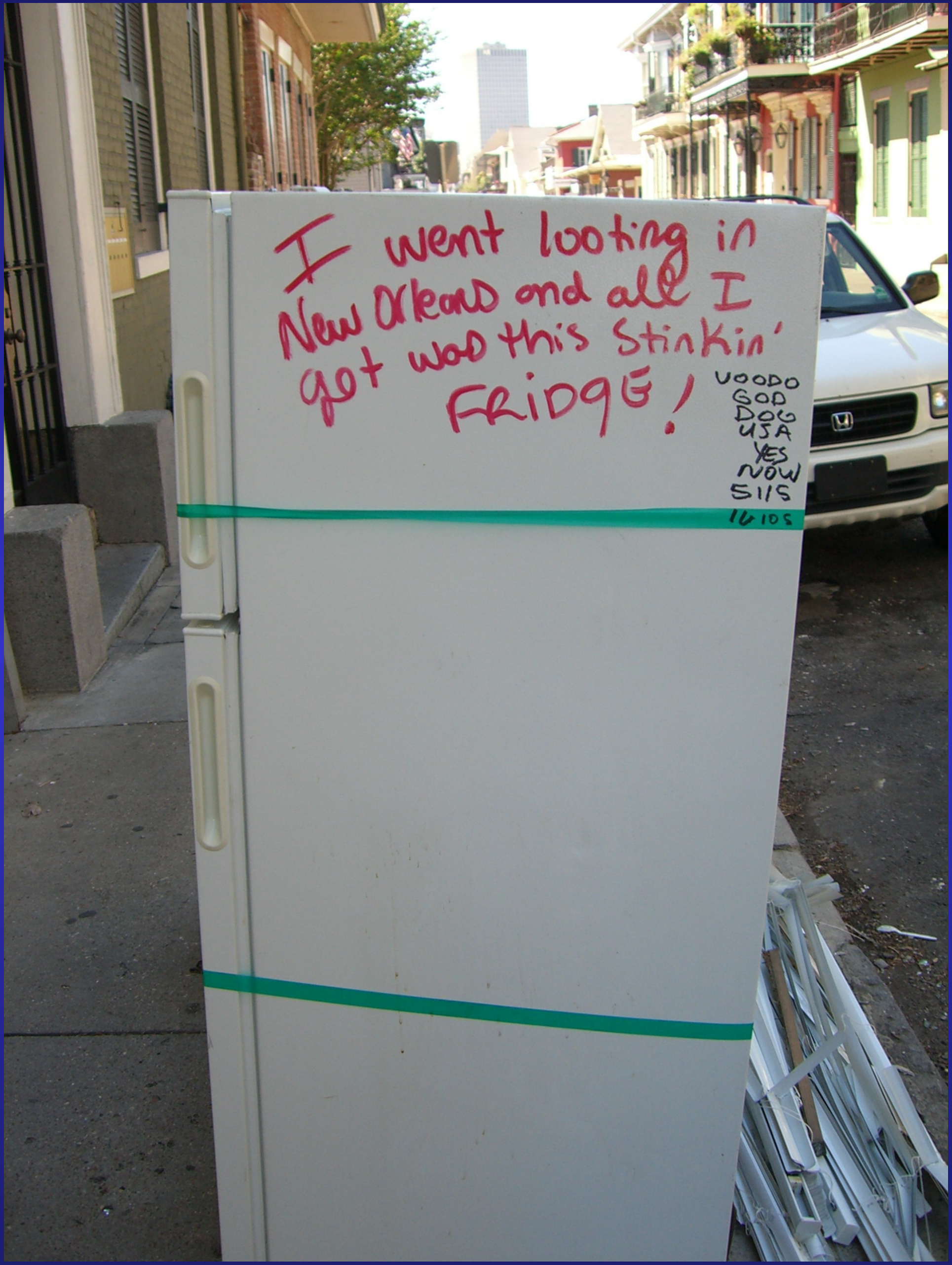

Lake Pontchartrain
Lake Borgne
New Orleans East
New Orleans East
Six Flags Amusement Park
Jahncke P/S (#14)
Citrus P/S (#10)
St. Charles P/S (#16)
Maxent P/S (#18)
P/S #15
Dwyer P/S (DR)
Grant P/S (GG)
Amid P/S (#20)
P/S #2
P/S #1
P/S #12
P/S #4
P/S #7
P/S #3
Canal St. P/S
P/S #6
Monticello P/S (MONT)
P/S #2
P/S #17
P/S #19
P/S #5
Orleans East Bank
P/S #1
P/S #6
P/S #12
St. Bernard Parish
P/S #3
P/S #7
St. Bernard Parish
P/S #4
P/S #5
St. Bernard Parish
P/S #8
E - 2
W - 4 b
W - 3 a
W - 2
Levee Breaches
Storm Induced
Deliberate
Closed
Pumping Stations
Greater Than 90% Capacity
40% to 90% Capacity
Less Than 40% Capacity
Under Assessment
Estimated Flood Extents
Pre-Katrina Wetlands
28 September 2005
Maximum
Levee Districts
Dry
Not Dry
East Bank Mississippi River
E-1 St. Charles Parish
E-2 Jefferson Parish East Bank
E-3 Orleans Parish East Bank
E-4a Orleans Parish East Bank - Citrus
E-4b Orleans Parish East Bank - Bayou Sauvage Refuge
E-5a St. Bernard Parish - Chalmette
E-5b St. Bernard Parish
West Bank Mississippi River
W-1 Cataouatche
W-2 Westwego to Harvey Canal
W-3a Harvey Canal to Algiers Canal
W-3b Harvey Canal to Algiers Canal
W-4a Algiers Canal to Hero Canal
W-4b Algiers Canal to Hero Canal
0 1 2 4
Miles
N

The Big Easy

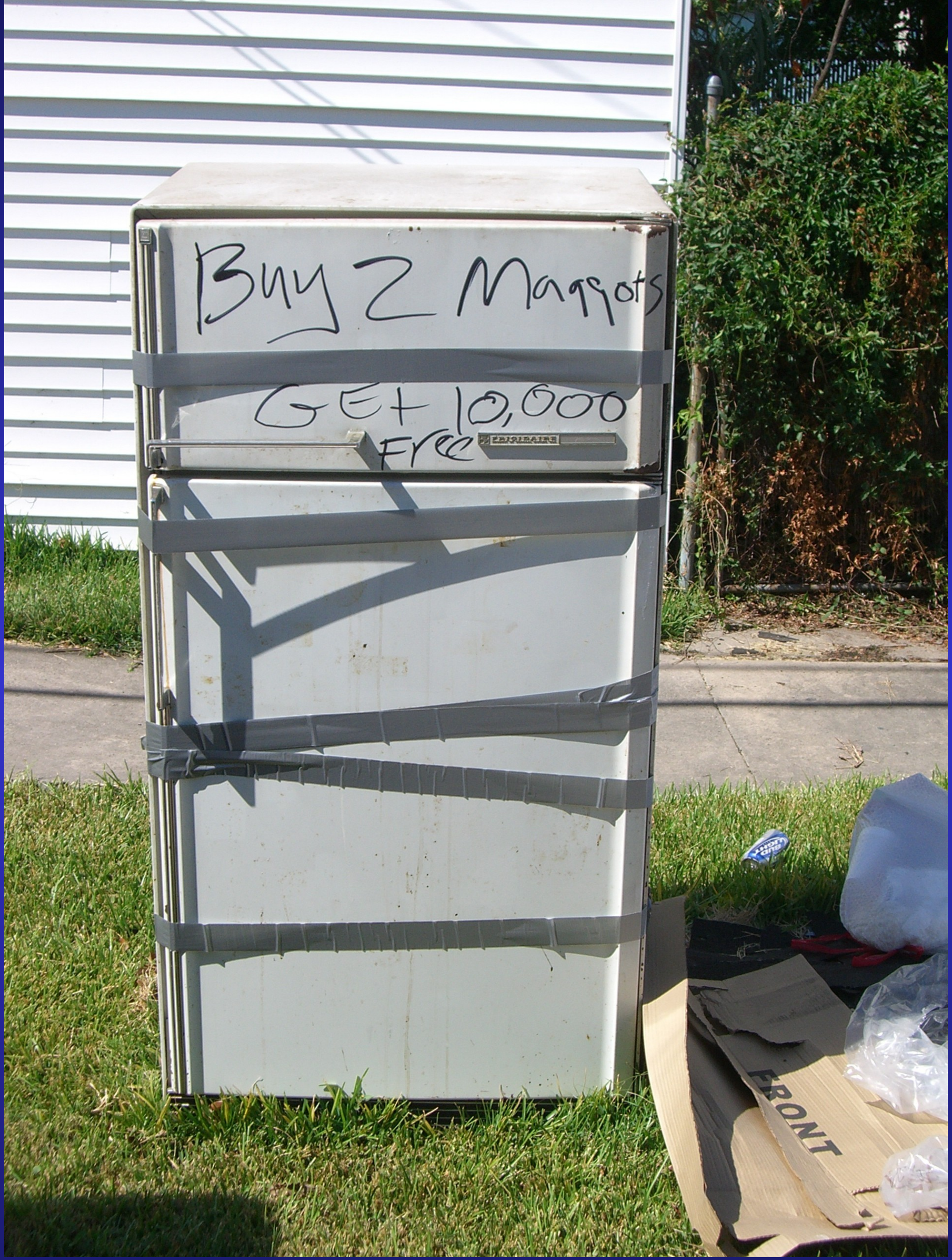
Refrigerator Graveyard



US Army Corps of Engineers ®


I went looting in New Orleans and all I got was this Stinkin' FRIDGE!
VOODO
GOD
DOG
USA
YES
NOW
5115
11 105

One Team: Relevant, Ready, Responsive, Reliable


Buy 2 Maggots
Get 10,000
Free
FRIGIDAIRE
FRONT

MY
TUMMY
HURTS
CASIO
NEW
20 INCH
BOX

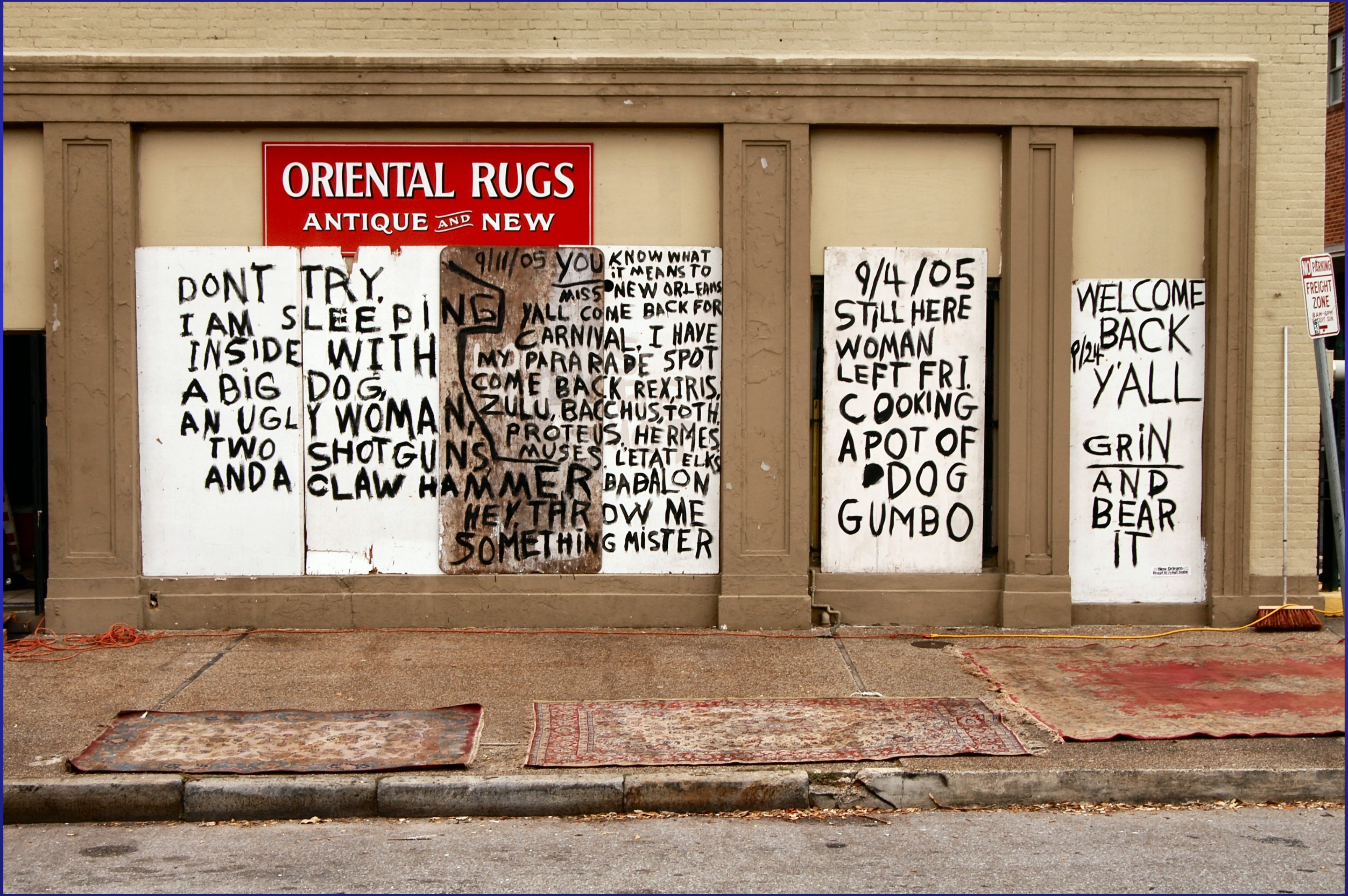
Canon
CABLE CROSSING
U.S.ARMY

CNN
Hi MITC
xoxoxo
-Soledad

US Army Corps of Engineers ®

Hi Mit
xoxoxo
-Soledad

One Team: Relevant, Ready, Responsive, Reliable


ORIENTAL RUGS
ANTIQUE AND NEW
DONT TRY.
I AM SLEEPING
INSIDE WITH
A BIG DOG,
AN UGLY WOMAN,
TWO SHOTGUNS
AND A CLAW HAMMER
9/11/05 YOU KNOW WHAT
IT MEANS TO
MISS NEW ORLEANS
YALL COME BACK FOR
CARNIVAL. I HAVE
MY PARARADE SPOT
COME BACK REX, IRIS,
ZULU, BACCHUS, TOTH,
PROTEUS, HERMES,
MUSES, L'ETAT, ELKS,
BABALON
HEY, THROW ME
SOMETHING MISTER
9/4/05
STILL HERE
WOMAN
LEFT FRI.
COOKING
A POT OF
DOG
GUMBO
WELCOME
BACK
9/24
Y'ALL
GRIN
AND
BEAR
IT
NO PARKING
FREIGHT
ZONE
8AM-6PM
EXCEPT SUN

US Army Corps
of Engineers ®

QUESTIONS?

One Team: Relevant, Ready, Responsive, Reliable